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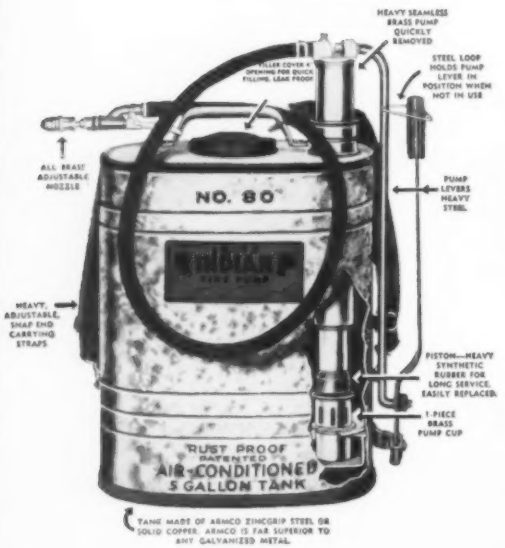
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Photo courtesy U. S. Forest Service

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Journal of Forestry

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Economic Aspects of Type Maintenance and Conversion in Loblolly Pine—Hardwood Region[1]

Carl H. Stoltenberg
Assistant professor of forest economics, School of Forestry, Duke University, Durham, North Carolina

ECONOMIC analysis is a useful tool in answering the "how-much" and "where" questions of type maintenance and conversion. The function of economic analysis in such managerial problems is limited, but vital; it is to serve as a measuring device, nothing more, or less. It is the businessman's yardstick. Over the silviculturists' cords, cubic feet, and acres, economics superimpose a value scale, in which not only yield values are measured but also associated production costs.

Notice that the economist applies these value calipers to biological and technological data. And no matter how shrewd his calculations and how well adjusted his calipers, his results can be no more accurate than his basic biological data. If the silviculturist cannot predict the volume yield of stands with different stocking, species composition, and on various sites, surely the economists' value calipers will be useless. We must have biological facts before we can make any sort of economic analysis.

The forest economist needs to discuss with silviculturists the type and form of data his calipers are equipped to measure. Thus I would like to introduce the subject of this paper by attempting three things: (1) to define the problem; (2) to discourage efforts to generalize solutions and; (3) to discuss a few of the biological relationships concerning which we need data.

The Problem—How Much Investment in Pine

Loblolly pine (*Pinus taeda*) grows naturally from Texas, Oklahoma, and Arkansas through the Gulf states and northward in the Atlantic Coast states to the southern tip of New Jersey. Throughout its entire range loblolly pine competes with hardwoods for light, moisture, and soil nutrients under conditions varying from those of the bottomlands and flatwoods of the Coastal Plain to the broken topography of the Piedmont.

Biologically, loblolly pine *can* be grown on all but the most extreme sites throughout this entire area. But being less tolerant than most competing hardwood species, pure pine stands can be established and maintained only by retarding nature's forces of succession.

Dues Deadline June 30

June 30 is the deadline for the payment of 1956 Society dues. Members whose dues are not paid by this date will be in bad standing and will be ineligible to vote, receive the Society's publications, or be a candidate for office until their dues are paid. In cases of financial stringency the Council may, upon request, extend the period during which current dues may be paid.

Prompt payment is mutually advantageous since it helps the Society in budgeting income and expense and assures delivery of Society publications to members.

Growing pine thus involves management and consequently positive action and financial investment by the owner. Although each owner knows he can grow either hardwoods or pine, his problem lies in deciding how large an investment in growing the less tolerant pine will be profitable under various forest conditions.

Emphasis on product.—Or stated in a different way, when we convert hardwood stands to pine, or maintain pine at the expense of hardwood, we are buying pine. I believe it helpful to think of these management problems in this light.

Thus we should focus our attention on the amount of product (pine) we are buying for any given conversion investment, rather than on the number of acres that are converted by that investment. In the automotive industry a production engineer is not particularly concerned because Plant A, which runs three times as fast as Plant B, requires three times as many body parts and twice as many automotive workers to maintain production. The engineer is not dismayed because the costs per day are 2½ times as high for Plant A as for Plant B. Yet how often have you heard such statements as "We feel we can't afford to pay more than twenty dollars per acre (or some such amount) to convert hardwood stands to pine?"

Early results of the Southeastern Station's[2] loblolly-pine growing

[1]Paper presented at the Allegheny Section Meeting, S.A.F., February 10-11, 1956, Bellevue-Stratford Hotel, Philadelphia, Pa. Meeting subject: "Maintaining Pine or Converting Hardwood to Pine."

[2]Southeastern Forest Experiment Station, Forest Service, U. S. Dept. Agric., Asheville, N. C.

space studies indicate that within surprisingly wide limits stocking and age have relatively little influence on volume growth per acre. However, stands on good sites, but with identical stocking and age, are producing five times as much product as those on poor sites.

Thus even a low investment of $10 per acre on poor site might not be profitable. But on the best sites $30-or $40-per-acre investments might pay handsomely. In terms of the cost of pine, the $10 per acre costs on poor sites, might mean $8 or $10 pine per cord as compared with $5-per-cord pine resulting from the supposedly high cost $30-or $40-per-acre investment on good sites. From an economic viewpoint, costs are high or low only in relation to the yield so purchased. Let's keep our eye on the product, not the acre.

Type-conversion only one method.—We must also recognize that type conversion and maintenance efforts are only two of several different ways an owner may produce more pine. We foresters recognize this but sometimes we become so enthusiastic about some one production method, such as type conversion, or perhaps fire protection, that we push this method so far that some of the last units of product so produced are indeed very expensive cords, or board feet. And at the same time we may be neglecting other production processes such as planting, protection, thinning, wet-land drainage, or more intensive utilization — production processes by which we might be producing the same additional amount of pine product but at a lower cost per cord. And of course the amount of pine we are buying by type conversion depends upon the extent of our protection program, closeness of utilization, our thinning regime, etc.

Thus the wisdom of investing additional sums in maintaining pine or converting hardwood to pine depends not only upon the cost of pine thus produced but also upon the opportunities for using these funds to buy more pine at a lower cost through some other production process. After all, if your wife wishes to be well dressed, she wouldn't dash out and spend all her money on 8 or 9 new hats —she'd be more likely to buy only 4 or 5 hats and spend the rest of that money on a new pair of shoes and a new dress. (That is, unless she spent last month's check on dresses and shoes!)

Clearly, the wisdom of adopting any single management practice is dependent upon many other conditions and practices of management.

A General Solution is Impossible

Perhaps these thoughts may help to outline the problem—but what sort of solution should we be looking for? Because problems in forestry have been so numerous and complex relative to the number and knowledge of foresters, in the past we have sometimes tended to seek simplified solutions that have bypassed some extremely important variables. One of the most important of these variables bypassed in discussing optimum management practices is ownership.

To illustrate the point, take farming as an example. What determines the crops a farmer will grow, and what production methods he will use? The site? Certainly soil, climate, etc., are important influences. But the previous experience of the farmer, his financial condition, the size of his farm, his equipment, and even the size of his family will influence what he raises and how he goes about it. Is the farmer who has only a small farm and little capital foolish because he uses mules rather than tractors and raises different crops than his neighbor across the road who manages a very large, well financed farm? Is he necessarily practicing "poor management?"

Few of us would say he is. But in the management of forests we frequently seem to ignore similar differences. Sometimes we seem to forget that the costs of silvicultural treatments will depend to a large extent on the size of the tract, the availability of labor, the owner's knowledge, his interest, and the equipment at his disposal. And of course the value of the products produced depends greatly on the owner, too. Just who that owner is, is a very important consideration.

For example, on one hand we have public owners such as the people of Pennsylvania, represented by the Pennsylvania Department of Forests and Waters. Pennsylvanians realize a large proportion of their "income" from public forest management in the form of game and other recreational benefits. These products are not sold on the open market, but they nevertheless amount to actual income. The tax-paying public owners reap these public benefits or incomes.

But certainly the private owner of a small tract that is besieged annually by trespassing hunters or fishermen and that indeed is sometimes burned by them, will not consider such attractions as income. Actually they may be a net cost to him. How differently these two owners would analyze the profitability of any type-conversion plan which might increase timber income but drive turkeys, deer, or other wildlife away.

One more example of the importance of ownership. Consider the case of two forested tracts, a large one owned by a lumber company and a small one owned by a farmer. How different their costs are! How different is their knowledge of forest yields and forest practices. And perhaps most important, how different their objectives are! The lumber company may be seeking to provide a mill with a certain proportion of its sawlog supply. Any increase in tree or log quality will accrue directly to the company.

But the farmer is concerned primarily with farm rather than forest management—and wisely so. He would be foolish to manage his forested land to maximize income from this source if in so doing his total farm income would be reduced. He may prefer to grow pulpwood rather than saw timber because a nearby mill offers a de-

pendable market year in and year out, and perhaps even management services. Or he may place a rather high value on a woodlot that provides small, straight pine posts. Another half-dozen ways could be added in which incomes and costs would differ radically for these owners even if identical management programs were adopted. Surely we cannot ignore such important differences in considering the size of the investment that would be profitable in growing pine.

A conclusion on ownership? It might be this: While biologically stands react to treatment the same regardless of ownership, the profitibility of any action is so dependent upon ownership factors that virtually no generalizations regarding optimum type-conversion, type-maintenance, or other forest practices can be made without knowledge concerning the owner's situation.

We may say farm forests on the average are biologically "less productive" than public forests. But this does not necessarily mean that farm forests are being managed less wisely—nor that the easiest and least expensive means of growing more wood nationally is to be found in programs dealing with owners of "unproductive" farm woodlands. We cannot generalize concerning optimum practices—each solution must be based on the owner's situation, his other management practices, and other factors, as well as the forest's biological condition.

Back to the question of what sort of solution we are seeking to type-conversion or type-maintenance problems. If we agree that each tract requires individual consideration, then we are not seeking rule-of-thumb solutions concerning "good" forestry practices. Instead, we are looking for sound estimates of treatment cost under various ownership and forest conditions, and the magnitude of values likely to result from such treatments—data from which a forester on the ground may select information appropriate to any individual set of economic, biological, and ownership conditions. In so doing, we are adopting a truly professional attitude toward forestry—we are now throwing out the rules-of-thumb of forestry's "doctor-book" stage of development, and substituting professional diagnosis and treatment of individual cases.

What Data Are Needed

But what information must the forester have to analyze an individual owner's situation and make appropriate recommendations? In what form will it be most useful? What is the status of our knowledge concerning some of these biological and technological relationships?

Despite years of study, our knowledge concerning many of the biological relationships in the loblolly pine-hardwood type is surprisingly inadequate. We know that more pine can be grown on good sites than poor—but little about the magnitude of this relationship. One experienced forester may estimate potential production on Site 80 at double the amount estimated by another—this in a region where we can evaluate site quality better than in almost any other region! We know even less about the specific effects of stand density and age on the volume and quality of forest growth on a given site. But the Forest Experiment Stations are now compiling the early results of studies which should greatly improve our knowledge of these relationships. Coordinated analysis of remeasurement data from the thousands of permanent inventory plots industrial foresters and Forest Survey men have established should also provide very valuable information. But we must know more about the actual volume and quality of forest growth that can be expected on various sites for various stand ages and densities.

Better information on prospective markets is also needed by the forester, because the profitability of type-conversion efforts will depend on future markets.

Without attempting any quantitative evaluation of future prices, let me refer to an article in the January *Harvard Business Review* by J. J. Spengler, one of the world's most respected students of population growth. Dr. Spengler predicts a United States' population of over 300 million persons by the year 2000. If the real price of forest products doubled during the first half century while population increased by only 75 million, what will the price rise be during the second half century when we are anticipating a population increase of more than twice that amount—an increase of more than 150 million persons?

Certainly this means a higher value for pine—of all sizes and qualities. It means closer utilization, and probably a trend to products such as pulpwood in which a high proportion of the wood grown can be converted into end products. Both the Stanford Report and the Timber Resource Review have implied major price increases during the next 20 years, but the fruits of type conversion or maintenance will be harvested in periods of even greater population pressure on resources.

The forester must appraise the owner's probable future management practices, because as we have said, the profitability of converting a hardwood stand to pine today will depend in part on how well the owner will protect the stand from fire, insect, and disease attack tomorrow. And if pine sawtimber is to be grown, the forester should know whether the owner will be likely to prune and perform other cultural practices, and whether he will likely perform the necessary type-maintenance measures once he has converted to pine. To a certain extent the forester must rely on general impressions in seeking answers to such questions, but if he is equipped with biological and technological data that tell him just when and how many man hours will likely be required for such practices, he and the owner will be in a much better position to estimate the likelihood

of their being accomplished. We need to know more about the timing and costs of various cultural practices, and their effect on product volume and quality.

One cost the owner must "pay" to produce pine will be determined by the value of the hardwoods the land would be producing if pine is *not* favored. Obviously costs of this sort will be high in the bottomlands where pine competes with such valuable species as yellow-poplar (*Liriodendron tulipifera*) and black gum (*Nyssa sylvatica*), and in the flatwoods where sweetgum (*Liquidambar styraciflua*), cherrybark oak (*Quercus falcata* var. *pagodgefolia*) and the water oaks are competitors. Costs of such "foregone opportunities" will of course be lower on the uplands where components of the less valuable oak—hickory type are the major competitors of pine. But if our knowledge of pine growth is limited, our knowleldge of hardwood growth is almost non-existent. Studies to rectify this situation are now being established.

We have pointed out how costs of other managerial practices are important. Obviously, the cost of practices designed to actually control the hardwoods are equally important. A few studies have been made of controlled burning, chemical and mechanical deadening, mechanical clearing, and other hardwood control tools under various stand and topographic conditions. Industrial and public agencies might well cooperate in additional studies to round out such data so that foresters will be in a better position to advise owners concerning the probable control costs on any specific tract.

I fear I have not turned a very brilliant spotlight on an answer to this problem of what efforts in maintaining or obtaining pine will be profitable. But I hope I have discouraged any hopes we might have been holding in the back of our minds concerning the possibility of finding any general solution to the problem. And I hope we will accept the challenge to adopt a professional attitude in facing this problem. This will require developing a solution fitted to the conditions of each owner and each forested tract. This in turn will require much better data on hardwood control costs under various conditions, and better data on the volume and value of pine growth we can expect of various stand structures on different sites. I hope we will endeavor to obtain such data and put it to use as soon as possible. Only by so doing can we fulfill our function of efficiently managing America's most valuable replaceable natural resource, her forests.

Directory of Membership

A directory of S.A.F. membership appears as a supplement to this issue of the JOURNAL. This directory was authorized by the Council at its June, 1955 meeting, to be published "by a reduction in the Journal budget if necessary."

Total costs of the directory, received by all members, approximate $6,500. Prudence indicates the desirability of reducing JOURNAL costs during the current year until the costs of the directory have been at least partially absorbed. This will explain why some issues of the JOURNAL are not as large as usual.—*The Editor.*

The Other Side of the Mountain[1]

W. S. Rosecrans
Chairman, California State Board of Forestry, Los Angeles

The author analyzes progress in the application of forestry practices in California. He relates future problems in forestry to those that will be faced socially and economically by a state with an unparalleled population growth. He challenges the forestry profession to greater leadership.

IN LISTENING to our program I have been particularly impressed with its timeliness. It is opportune and profitable to take stock periodically of our progress and failures in the field of forestry. It is appropriate moreover because forestry in California is dynamic. Great changes have happened during the last few years: these changes not alone effecting professional methods and techniques but the public attitude and the whole economies of forestry in our state. I can not help thinking in this connection of the period which has elapsed since I became chairman of the California State Board of Forestry, almost twelve years ago, and of the role the state has played in the protection and management of our wild lands.

I find myself with mixed emotions as I look back over the past twelve years. When we undertook the work of reorganizing the forestry program of California, at the suggestion and under the leadership of Governor Earl Warren, I don't think many of us realized the immensity of the task involved. I remember being asked by some of our timber owners if I would be willing to stay with the job for three or four years. I remember very well my reply in the affirmative, but I thought that the job would be well on the way to completion in less than that time. Although we have made substantial progress in many ways, some objectives have eluded us and our goals still seem remote.

Of our accomplishments, I think the most fundamental and most important was our decision that forestry could not be imposed upon the people of this or any other state by the strong arm of bureaucracy. We felt then, and have never changed our minds, that better forestry had to be achieved by an educational process and in cooperation with the people concerned. We were convinced that compulsion with the use of police power could only be applied against a very small and recalcitrant minority. It had to be a grass roots program in which the people who owned the land, cut the trees and manufactured them into forest products were consulted.

We recognized that there were three distinct fields of activity, namely, forest management, watershed management, and range improvement, with some difficult conflicts of interest. We were certain that there would have to be a high degree of cooperation and tolerance between the various interests if we were to achieve substantial progress. We acknowledged the necessity of protecting the forest resource from destruction by fire, insects, or disease. Along with the other agencies we have made substantial progress in fire fighting techniques, yet perhaps not as much as we would have liked. The same may be said in connection with the control of forest insects and diseases. We have inaugurated a state wide campaign of fire prevention education which I believe has been primarily responsible for lessening the number of man caused fires. It is my judgment that our decision in permit-controlled burning for land clearing has been an important factor in reducing the number of incendiary fires.

I have mentioned these items of progress and yet personally I feel that our progress has not been sufficiently adequate to meet today's conditions. I am particularly impressed with this when I drive around the state and look at some of the lands cut over in recent years. There are some very creditable examples, but there are also some that look pretty sad and are far below our expectations of a few years ago.

The industry in 1944 was I believe quite sincere, if somewhat optimistic, in its view that adequate forest practices could be secured solely by education without legislative penalties. I do not think that the industry in 1944 visualized the tremendous change that was to happen in a few years after the war, when so many small logging and sawmill operations were to be started which would be extremely difficult to locate and control, where the operator would be in one place for a few months and somewhere else by the time his errors might be noticed. Had the situation not changed, it is possible that the method which was devised in 1944 might have been adequate. As it is, I think we must recognize that we are trying to administer our present forest practice regulations under conditions that were not contemplated at the time that they were written. I think most leaders in forestry will admit that we must take a good look at our forest practice laws and regulations during 1956 in order to prepare amendments or changed procedures adequate to assure the proper harvesting of our timber and to provide conditions favorable to forest regeneration and the growth of a continuing supply of forest products.

We often speak of watershed management, yet it is a subject concerning which we do not know too much. We have made some

[1]Presented before the Annual Meeting of the Northern California Section, Society of American Foresters, on December, 3, 1955 at San Francisco, California. Theme of meeting: "How are we doing, and where are we going in getting forestry applied on the ground."

progress in forest fire protection but when it comes to actually managing a watershed I think the phrase is still no more than a pious hope.

In connection with range improvement, there is much interest, activity and a better understanding of the complexity of brush conversion. The conflict of interest between livestock people and timber owners remains a formidable problem. We are, however, generally, able to discuss these controversial matters in a reasonable way. There are some good examples of the conversion of brush to grass. As to the overall success of the range improvement, and the economics of conversion, there is still a lot to learn. Undoubtedly the demand for forage, that may be expected to increase during the coming decades, should prove an impetus to better range management and should place a premium on improved range conditions.

All this leads me to wonder why, with so much planning, effort, and cooperation, our progress has been so spotty? Why do we have so many conflicts of interest? Why are there so many complexities in the way of better management of our natural resources? It seems to me that some light might be shed upon the subject if we would consider California's economic position in the western states, and the remarkable changes that have taken place since the year 1940.

California occupies a unique position among the states. It plays a very important role nationally and also an important role regionally among the eleven western states. A part, at least, of the great development of California during recent years may be attributed to her role in interstate development. It is interesting, therefore, to make a few comments about the eleven western states and California's position among them. These states comprise 40 percent of the area of the United States and contain 75 percent of the nation's national forest land. California represents 13 percent of the west's land area, has 20 percent of the forest and watershed lands, and 14 percent of the national forest lands. On the other hand, by striking contrast, with less than 15 percent of its land arable, it has 56 percent of the West's population and 67 percent of the manufacturing employment. It has 46 percent of the cash farm income, 67 percent of the value added by manufacture, 44 percent of the value of mineral production and 26 percent of lumber production. California reports 62 percent of the personal income of the eleven western states and pays 67 percent of the federal taxes collected in these states.

Even more surprising is California's phenomenal population growth since the start of World War II, and more particularly since 1946. Historians tell us that this growth has no parallel and that the population coming into California in this period is the largest voluntary mass migration of record. In fourteen years California has added 5,600,000 people to its population. This is just 600,000 people less than the total growth experienced in the same period by all other states west of the Mississippi. California seems destined to continue a rapid growth rate for many years. Currently, its growth is estimated to be 450,000 persons per year.

It is striking to note some of California's percentage gains in the same period. For instance, an increase of 81 percent in population, 161 percent in manufacture employment, 350 percent increase in farm income, 645 percent increase in the value added by manufacture, and a 381 percent increase in the volume of retail sales.

California is the only state in the Union that has two metropolitan areas of size comparable to Los Angeles and the San Francisco Bay Region. More people live in these two metropolitan areas than the combined population of nine of the eleven western states. Only six of our forty-eight states have a population larger than the metropolitan area of Los Angeles. The San Francisco Bay Region metropolitan area has a larger population than any of twenty-five of our forty-eight states.

These unprecedented economic changes have created a great pressure on our natural resources and emphatically emphasize the need of adequate and productive management for our wild lands.

And now the question comes, how are we to make more progress in the management of our wild lands and what will contribute most to it? From my experience, working in public matters over a long period of years, the most essential ingredient to all progress and achievement is *leadership*. Of course, in addition there will be required vigorous effort backed up with sound technical knowledge and the expenditure of substantial sums of money, both from the public treasury and individual landowners. The prime requirement will nonetheless, be a limited number of men of character, of civic responsibility and extensive knowledge, plus that indefinable urge that makes some men stand out just as the great trees in the forest. This is the kind of leadership that will be required. Such men should have the necessary technical skills reinforced with a broad cultural knowledge and the ability to express themselves in speech and writing correctly, gracefully, and fluently. From what source will we get such leadership? Will it come from the political field, from agriculture, from business, or from forestry? That, of course, is a question which can only be answered with the passing years. It does, nevertheless, seem reasonable to me that a substantial portion of such leadership should come from the forestry profession.

Is the profession, however, ready for this great challenge? Admittedly, our various schools of forestry are turning out a substantial number of men, equipped with the recognized techniques. In meetings such as this one we learn of the activities of such men. We know that many of them have demonstrated a high degree of competence in the way that they are handling their respective assignments. At the same time I can't

help wondering whether most of our foresters look beyond the trees on this side of the mountain.

I wonder how many look at what may be on the other side of the mountain, not alone at the timber, but at the complex vegetative pattern, the priceless watershed values, the changed ecological conditions caused by the harvesting of trees. Above all, I wonder if most foresters think enough about the soil? In the final analysis the trees are just the particular crop that happens to be growing on a special soil area. They may be the climactic crop. Perhaps some other crop on the same land might be even more productive. After all, the trees are just a growing crop, the soil is fundamental. Yet it is anomalous to speak of soil as being fundamental, because *fundamental* suggests stability, when there is nothing so unstable as soil, nothing so easy to destroy, or so painfully slow to recreate. As we think of the other side of the mountain, we all recognize that the greatest crop that comes from the mountain is the water. California is the only state in our Union which has a Mediterranean climate with the corollary of required irrigation and water management. It has a large natural water supply very unevenly distributed, with areas completely arid, with meager supply, with adequate supply, and with great surpluses. We might go on at length making an inventory of what may be on the other side of the mountain, but enough has been said to indicate that there are many challenging and important problems.

In speaking of leadership, as we look about we see a number of foresters who stand out among their fellows and who are playing important roles. Have they secured the training to qualify them for this leadership in their professional schools or have they acquired it vicariously? Personally, I think the latter. In my judgment this is a problem to which the Society of American Foresters should give very serious consideration. Rather over-simplified, it is whether, as the techniques of the profession of forestry become more numerous and difficult, foresters are going to be predominantly t e c h n i c i a n s or whether they are going to be managers, executives, and leaders? The same situation is being faced by other professions, for example, engineering in its various branches.

It is obvious that the complexity of this industrial super-scientific age requires an adequate supply of technicians. It may be said, on the other hand, that the need for informed, skillful, and farsighted leaders who will take responsibility is equally urgent. If the profession of forestry wants to have its members qualified for this broader and all important field of leadership, it will be opportune to examine the basic training in our schools of forestry. In my humble judgment, the necessary techniques required to qualify a forester in his profession in a four year course do not leave much time for culture or for the broad knowledge which a man should have if he wishes to rise above the grade of a technical cog in our complex civilization. May I list some of the subjects that I think the trained forester of tomorrow should have if he wants to rise above the average: Most obvious is an adequate knowledge of written and spoken English, and a reasonably broad knowledge of English literature. He should have at least an elementary knowledge of economics, and of what we used to call "Civics." Also it will not hurt his chances at all if he has some additional cultural background, such as the knowledge of a modern or ancient language, or of the appreciation of art and music. Some will ask how can this be done in a four year course, and my answer is, *it can not*. The problem may be solved in one of several ways: One would be to require a five year undergraduate course, another, perhaps, to give a four year course, granting a Bachelor of Science but requiring a Master's Degree to qualify for the profession of forestry. After careful study the decision must be made by the leading authorities of our technical schools, in consultation with the Society of American Foresters.

There is another phase of training which should likewise be considered, namely, subprofessional. There is a definite need for qualified technicians in forestry whose competence and usefulness is not necessarily increased by the holding of a college degree and whose training might be adequately provided for in less than even a four year course.

Another matter of great importance is more adequate recruiting for the profession. Occasionally someone recommends to some young man of pleasant personality, who likes the out-of-doors but who is not conspicuous for brain power, that he ought to be a forester. I think that the profession should make a special effort to recruit men of high mental capacity.

It has been written "Give us men to match our Mountains." This is sound and fundamental in any field. As to forestry, may we be a little more specific, may we say "give us foresters, men of high ability and good character, with ideals of citizenship and with the technical requirements of their profession, plus a broad cultural and economic training, who are willing to take the risks that leadership involves, who are not afraid of work nor of responsibility; give us, in fact, foresters to match our mountains."

Growing Stock Volumes in Unmanaged and Managed Forests

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MANY foresters are now giving consideration to the problems of regulation of the growing stock in managed forests. Recent JOURNAL OF FORESTRY articles (*5, 6, 8*), and recently developed gross yield tables (*8, 15*) attest to the increasing need for gross yield table data.

Any discussion on the subject of forest growing stock inevitably involves a review of such concepts as "fully stocked" stands, "normal" growing stock, "normal" forests, "normal" increment, "normal" age class distribution, and "normal" yield tables. Each such discussion will unquestionably bring into play debate upon even- and uneven-aged stands and forests and upon managed and unmanaged stands and forests. Unless there is a common ground of understanding in the terminology being used, much confusion results. It is not necessary to redefine these terms,[1] but it does seem desirable to comment upon the interpretations of some of them.

Fully Stocked Stands and Full Increment

The confusion that exists concerning what constitutes full stocking in an even-age stand is aptly expressed by Baker (*1*), who wrote: "On the one hand, foresters have computed growth of stands by comparison with yield tables by direct proportion, reasoning that if stand A has 80 percent of normal basal area, its growth is 80 percent of the yield-table value. And on the other hand, in all seriousness, they recommend thinnings to remove perhaps 20 percent of the basal area 'to increase growth.' Obviously, something is seriously at fault."[2] Baker then presents data by Moeller (*12*) showing that full or "normal" increment is obtained on any basal area falling between 60 percent and 100 percent (and perhaps more than 100 percent) of the full stocking indicated in normal *net* yield tables. This has been borne out amply by work in this country, particularly in the southern pine region. Staebler (*15*) recognizes the fact in recent work with Douglas-fir.

When is an even-aged stand fully stocked? No simple answer will suffice. Normal net yield tables are designed to show what numbers of trees, and what volumes and basal areas will be carried in fully stocked, unmanaged stands at different ages. But the managed even-aged stand will carry fewer trees and generally less volume per acre, yet will produce as much volume growth and considerably more value growth than the unmanaged stand with its higher volume. The answer is that each stand is "fully stocked," and we can use no single volume criterion to describe the term. Any stand which absorbs the full productive capacity, without waste, of the site factors, can be called fully stocked; any stand which does this, and, in addition, has a minimum of mortality and channels all of this productive capacity into high quality growing stock,, may be called a fully stocked *managed* stand.

Expressing a desired growing stock as a percentage of "normal" growing stock (from normal net yield tables) as suggested by Gross (*6*) serves only to conceal the fact that a desirable growing stock is the result of the application of the best silvicultural and management practices possible under the prevailing economic and market conditions. An even-aged stand under intensive management will receive relatively frequent intermediate cuttings. Each cutting reduces the stand volume below the full stocking suggested by a net yield table. But mortality is greatly reduced in this process and individual residual trees have grown faster. By analysis of the development of such an intensively managed stand over a series of decades, or for a rotation, we may find what stocking volume it has carried. We may then relate this volume to that given in a net yield table, if it is so desired, although no useful end is gained thereby. We might find, for example, that it has carried an average 80 percent of stocking indicated by a normal net yield table, and that it has produced 200 percent of the volume indicated by the same table. It does not follow that we set a desirable growing stock at 80 percent of the "normal" stocking indicated in the net yield table. The managed stand has been fully stocked throughout its life for the intensity of management applied. Another intensity of management may result in holding a different growing stock level from which is harvested an equal or a higher or lower gross cubic volume, depending upon how much mortality occurs in the stand. It should become increasingly clear that net yield tables offer no guide for the adoption of growing stock volumes or basal areas for managed stands.

Structure of the Unmanaged Even-aged Normal Forest

An acre of forest land, fully stocked with seedlings of a given species, and equipped with a given productive capacity (site quality) will produce a certain gross volume of wood over a period of years (*1*, page 370, *8*). If the stand on this acre is unmanaged and develops naturally, much of the produced wood volume disappears through natural mortality due to

[1] Definitions given in the S.A.F. publication "Forest Terminology" appear to be adequate in all instances.

[2] Pages 367-368.

competition. If the stand is managed in such a way that basal area is not too seriously reduced by thinnings, the remaining trees efficiently utilize the full productive capacity of the land and continue to produce the greatest attainable gross increment. In the latter case, much of the volume which would have been lost through stand competition is recovered in thinnings. Our normal net yield tables, giving data for unmanaged stands, do not consider volumes lost through competition and hence do not reflect the gross production of wood from an acre. Neither do they indicate the attainable gross recovery of wood volume from the acre when management is applied. They do, however, provide the information needed to calculate the growing stock requirements of unmanaged, even-aged normal forests.

The *length of rotation* largely governs the average per acre volume of growing stock which must be carried. We can visualize two forests of loblolly pine, one regulated for a 40-year pulpwood rotation; another regulated for an 80-year sawlog rotation. If we now adopt the classical concept of the normal even-aged forest with its acre by acre arrangement of age classes, we find that making a final harvest of one acre of rotation-age pulpwood each year requires a series of age classes from 1 to 40 years, each age class occupying 1/40th of the total producing power of the 40 acres. For the 80-year sawlog rotation, the fact that 80 acres are required to produce an annual cut of 1 acre immediately becomes apparent. The annual yield will be greater because the harvest is made in 80-year, not 40-year timber. Similarly, the growing stock volume required to produce this annual yield indefinitely is also much greater because 80 fully stocked areas are needed as the backlog. The growing stock volume required is determined by summation of yield table data for loblolly pine, site index 80 (*16*). For the 40-year pulpwood rotation:

$$\text{Growing stock} = 5\left(\frac{1{,}100+1{,}800+2{,}550+3{,}250+3{,}850+4{,}400}{2}\right)$$

$$= 73{,}750 \text{ cu. ft.}$$

$$\text{Average volume per acre} = \frac{73{,}750}{40} = 1{,}844 \text{ cu. ft.}$$

$$\text{Cutting percent} = \frac{4{,}400}{73{,}750} = 6\%$$

For the 80-year sawlog rotation:

$$\text{Growing stock} = 5\left(\frac{1{,}100+1{,}800 \ldots\ldots +6{,}250}{2}\right) = 296{,}875 \text{ cu. ft.}$$

$$\text{Average volume per acre} = \frac{296{,}875}{80} = 3{,}711 \text{ cu. ft.}$$

$$\text{Cutting percent} = \frac{6{,}250}{296{,}875} = 2.1\%$$

It is evident that the longer rotation requires a much higher average growing stock volume per acre, produces a larger annual cut, but exhibits a smaller cutting percent.

Structure of the Managed Even-aged Normal Forest

The managed even-aged normal forest retains the characteristic of areas of equal productive capacity in the various age classes, but growing stock volumes and yield volumes are modified by the application of intermediate cuttings. In Table 1 a comparison is made of yields in unmanaged upland oak stands in the United States (*14*) with those in managed red oak (*Quercus borealis*) stands in Germany (*2*). Bauer's data are presented in much the same way as the data for Douglas-fir were presented by Danish foresters (*7*) and by Heiberg and Haddock (*8*). Analysis of heights of dominant and codominant trees in Bauer's tables reveals that data represent site index 78. Hence, site index 80 in Schnur's net yield tables was chosen to give comparative data.

The volumes of the residual stands of different ages provide the basis for determination, by summation, of the average volume per acre of the growing stock of normal forests. It must be remembered, however, that the growing stock includes *half* the volume removed in thinnings. This is dem-

TABLE 1.—COMPARISON OF YIELDS IN UNMANAGED UPLAND OAK STANDS IN THE UNITED STATES WITH THOSE IN MANAGED RED OAK STANDS IN GERMANY

Unmanaged even-aged upland oak,[1] U.S., site index 80			Managed even-aged red oak, Germany,[2] site index 78				
Age	Trees per acre	Volume per acre	Trees per acre	Residual vol. per acre	Cut vol. per acre	Cumulative cut Vol. per acre	Total vol. produced
Years	*Number*	*Cu. ft.*	*Number*	*Cu. ft*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
10	49						
15	251						
20	406	620	719	529			
25	454	1,170	518	1,043	329	329	1,372
30	410	1,690	388	1,572	400	729	2,301
35	358	2,160	303	2,086	414	1,143	3,229
40	313	2,610	241	2,586	443	1,586	4,172
45	287	3,040	198	3,044	429	2,015	5,059
50	265	3,450	166	3,458	429	2,444	5,902
55	244	3,820	140	3,844	429	2,873	6,717
60	225	4,160	122	4,144	414	3,287	7,431
65	207	4,480	107	4,430	414	3,701	8,131
70	192	4,770	95	4,659	400	4,101	8,760
75	181	5,060	86	4,844	343	4,444	9,288
80	173	5,340	80	5,002	257	4,701	9,703
85	165	5,600	75	5,116	214	4,915	10,031
90	159	5.870	71	5,159	186	5,101	10,260
95	154	6,130	68	5,187	171	5,272	10,459
100	150	6,380	65	5,202	157	5,429	10,631

[1]From Schnur (*14*), tables 17, 18, 19.
[2]Adapted from Bauer (*2*).

TABLE 2.—COMPARISON OF GROWING STOCK AND YIELD VOLUMES IN UNMANAGED AND MANAGED EVEN-AGED NORMAL FORESTS OF OAK
(Figures obtained by summation of data in Table 1)

	Unmanaged even-aged upland oak in U. S., site index 80				Managed even-aged red oak in Germany, site index 78			
Rotation or area	No. of trees per acre	Volume per acre	Average annual yield/ac.	Cutting normal forests	No. of trees per acre	Volume per acre	Average annual yield/ac.	Cutting normal forests
Years or area	*Number*	*Cu. ft.*	*Cu. ft.*	*Percent*	*Number*	*Cu. ft.*	*Cu. ft.*	*Percent*
40	381	894	65.3	7.30	256	900	104.3	11.60
50	393	1,323	69.0	5.22	245	1,360	118.0	8.64
60	389	1,738	69.3	4.00	228	1,809	123.9	6.85
70	379	2,128	68.1	3.20	211	2,211	125.1	5.66
80	366	2,494	66.8	3.68	195	2,557	121.3	4.74
90	355	2,840	65.2	2.30	182	2,849	114.0	4.00
100	341	3,169	63.8	2.01	170	3,093	106.3	3.44

onstrated quite clearly graphically by establishing curves of volume over age, one curve representing the volumes before thinnings, the other representing volumes immediately following thinnings. The average volume carried is then estimated by fitting a third curve to the midpoints of the thinned volumes. This method was used in determining the average growing stock volume per acre in managed even-age normal forests, and is illustrated in Figure 1.

The residual volumes at different ages plus the cumulative volumes removed in thinnings up to the given ages represent the total volume production of the managed stands. In such reports as Bauer's on red oak and in the work of the Danish foresters with Douglas-fir, the records account for every tree. Such a record is a true *gross* yield table. Practical management in this country fails to capture all the volume lost in natural mortality. Increasing scarcity of timber and higher values in stumpage will result, however, in progressively higher percentages of gross volume produced being utilized.

Data in Table 1, which refer to stands, are converted to normal forest data by summation. The converted data are presented in Table 2.

In the comparison of growing stock volumes in unmanaged even-aged upland oak stands and normal forests with those in managed even-aged red oak stands and normal forests, we have an example revealing the managed growing stock volume to be practically 100 percent of the unmanaged growing stock volume. This volume of managed growing stock was maintained not because it represented a theoretical "normal," but because the prescribed silvicultural treatment and management practice resulted in the maintenance of a volume roughly equal to that suggested as full stocking volumes in unmanaged stands and normal forests. There is no relationship between the two sets of data; certainly a forest manager should place no dependence upon the net yield table data as a guide for his growing stock volume under management. Other degrees of intensity of management, and different cutting schedules could lead to employment of different stocking levels.

One such variation can be shown in the cutting schedule for Douglas-fir suggested by Heiberg and Haddock (*8*). The total yield from an unmanaged, fully stocked stand on site index 150 is given by McArdle and Meyer (*13*) as 13,500 cubic feet at age 90 (total stand, trees 2 inches d.b.h. and larger). The yields under management for the same site quality and same rotation age, as estimated by Heiberg and Haddock, total to 21,254 cubic feet. Comparative data are presented in Table 3. The average acre volume of growing stock for a normal forest of Douglas-fir managed on this proposed cutting schedule is 4,282 cubic feet, which is only 66.25 percent of the volume obtained by summation of net yield table data. The yield of the managed forest, however, is 57.4 percent greater than that in the unmanaged forest. Again, it must be pointed out that the growing stock volume in this case is determined as a result of an adopted cutting schedule, not because it was thought desirable to carry 66 percent of full stocking as indicated in a net yield table.

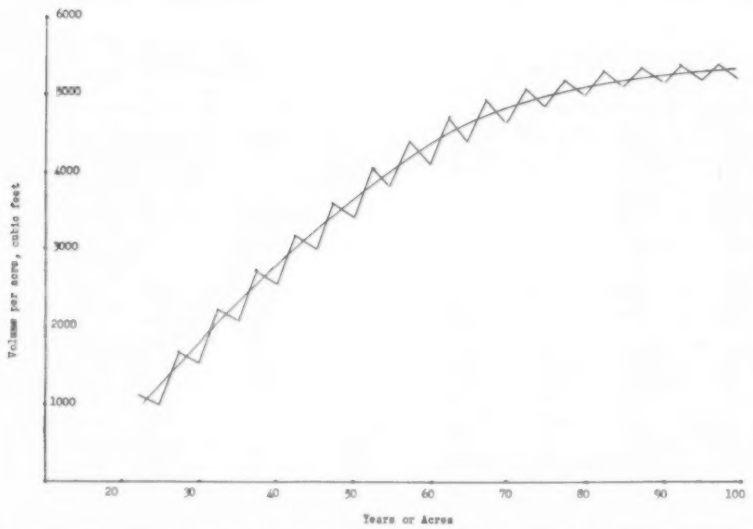

FIG. 1.—Growing stock of managed even-aged red oak stands and forests in Germany (*2*). The upper points represent residual volumes before each thinning, the lower points the residual volumes after each thinning. The curve of average growing stock volume is fitted to the series of midpoints. Thus is demonstrated why the average growing stock volume includes half the thinned volumes.

Structure of the Managed Uneven-aged Normal Forest

DeLiocourt originally recognized that a balanced structure (i.e., a structure characteristic of a normal uneven-aged forest capable of a sustained annual yield) consists of a decreasing geometric series of numbers of trees in successive diameter classes. For a given balanced structure, the quotient, q, of the number of trees in one diameter class divided into the number of trees in the next smaller diameter class should remain nearly constant. The value of this ratio varies with changes in the proportions of small-, medium-, and large-size timber in the forest, and it is affected by such factors as species composition, tolerance, and the developmental aspects of the species.

In this country, Meyer (*9*) has provided plentiful exposition of DeLiocourt's concept. Meyer and Keller (*10*) have determined the q values and the upper diameter limit of the diameter distribution in thirty different uneven-aged stands of upland oak in Pennsylvania. Average values of q may be used to calculate gradually differing structural types. The q values, upper limits of diameter distribution, and the distribution of volumes in cubic feet by small (5 to 13 inches), medium (13 to 21 inches), and large (21 inches and larger) timber are shown in Table 4.

It can be seen that changes in structure in uneven-aged forests toward larger percentages of large timber correspond to structural changes in even-aged forests as longer rotations are considered. Thus gradually differing structural types correspond to gradually differing rotations. While we cannot with assurance make a direct comparison of structural Type 1 in the uneven-age forest with, for example, a 60-year rotation in an even-aged forest, we can be assured that close correspondence exists in the range of structural Types I to V and rotations 60 to 100 in these studies in upland oak.

TABLE 3.—COMPARISON OF GROWING STOCK AND YIELD VOLUMES AND VALUES IN MANAGED AND UNMANAGED STANDS OF EVEN-AGED DOUGLAS-FIR

Unmanaged even-aged Pacific Douglas-fir (S.I. 150)[1]			Managed even-aged Pacific Douglas-fir (S.I. 150)[2]				
Age or rotation	No. of trees per acre	Volume per acre	No. of trees per acre	Residual volume per acre	Cut volume per acre	Cumulative cut vol. per acre	Total volume produced
				Midpoints			
	Number	*Cu. ft.*	*Number*	*cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
20	1,210	1,380	1,210	1,380			
30	735	3,610	610	3,250	584	584	3,834
40	510	5,750	332	4,630	2,780	3,364	7,724
50	377	7,730	191	5,430	3,340	6,704	12,134
60	296	9,490	123	6,200	2,430	9,134	15,334
70	242	11,060	82	6,750	1,320	10,464	17,214
80	207	12,400	57	7,150	2,260	12,724	19,874
90	180	13,500	49	7,500	1,030	13,754	21,254

Normal net growing stock by summation: 581,700 cu. ft.

Cutting percent: $\frac{13,500}{581,700} = 2.3\%$

Average volume per acre $\frac{581,700}{90} = 6,463$ cu. ft.

Managed growing stock by summation: 385,400 cu. ft.

Cutting percent: $\frac{21,254}{385,400} = 5.5\%$

Average volume per acre: $\frac{385,400}{90} = 4,282$ cu. ft.

[1]From McArdle and Meyer (*13*).
[2]Adapted from Heiberg and Haddock (*8*).

TABLE 4.—VALUES OF Q, UPPER LIMITS OF THE DIAMETER DISTRIBUTION, AND DISTRIBUTIONS OF VOLUMES IN FIVE GRADUALLY DIFFERING STRUCTRALURAL TYPES OF UNEVEN-AGED STANDS OF UPLAND OAK IN CENTRAL PENNSYLVANIA[1]

Structural type	Values of q	Upper limit of diameter distribution	Distribution of volume by diameter groups		
			Small timber (5″-13″)	Medium timber (13″-21″)	Large timber (21″+)
		Inches	*Percent*	*Percent*	*Percent*
I	2.014	26	75	23	2
II	1.822	27	65	29	6
III	1.649	27	55	35	10
IV	1.492	27	43	40	17
V	1.350	28	32	43	25

[1]Adapted from Meyer and Keller (*10*).

When is an uneven-aged stand fully stocked? No single criterion suffices. One stand may carry 2,000 cubic feet per acre and produce 80 cubic feet per acre per year. Another stand on a site of comparable quality may carry 3,000 cubic feet per acre and also produce 80 cubic feet per acre per year having a higher value per cubic foot than the first. Each stand may be using the full productive capacity of the site. Again, any stand which absorbs the full productive capacity, without waste, may be termed fully stocked; any stand which does this and, in addition, evidences a minimum of suppression and mortality, and channels the full productive capacity into high quality growing stock, may be called a fully stocked, managed stand.

Foresters are gradually accepting the fact that uneven-aged forests definitely are not intimate mixtures of even-aged stands. Baker (*1*), Davis (*4, 5*), Meyer, et al. (*11*), and others have demonstrated this. The adaption of net

TABLE 5.—COMPARISON OF GROWING STOCK AND YIELD VOLUMES IN MANAGED EVEN- AND UNEVEN-AGED FORESTS OF UPLAND OAK[1]
(All figures on per acre basis)

Managed even-aged normal forest								Managed uneven-aged normal forest							
Rotation	Trees	Growing stock Vol.	Growing stock Value	Annual yield Vol.	Annual yield Value	Cutting[2] percent	Finan.[3] yield	Struct. type	Trees	Growing stock Vol.	Growing stock Value	Annual yield Vol.	Annual yield Value	Cutting[2] Percent	Finan.[3] yield
Yrs. or acres	*No.*	*Cu. ft.*	*dollars*	*Cu ft.*	*Dollars*	*Percent*	*Percent*		*No.*	*Cu. ft.*	*Dollars*	*Cu. ft.*	*Dollars*	*Percent*	*Percent*
40	256	900	8.71	104.3	1.12	11.60	12.86								
50	245	1,366	17.41	118.0	1.98	8.64	11.37								
60	228	1,809	30.22	123.9	2.75	6.85	9.10	I	167	1,581	61.05	82.75	3.53	5.23	5.78
70	211	2,211	49.33	125.1	3.92	5.66	7.95	II	145	1,600	76.50	73.31	3.98	4.58	5.20
80	195	2,557	74.55	121.3	4.68	4.74	6.28	III	128	1,713	101.44	68.11	4.75	3.98	4.68
90	182	2,849	102.03	114.0	4.93	4.00	4.83	IV	118	1,973	143.99	68.24	6.14	3.46	4.26
100	170	3,093	127.84	106.3	4.91	3.44	3.84	V	113	2,543	232.33	73.75	8.38	2.90	3.61

[1]Adapted from Walker (*17*).
[2]Annual yield volume divided by the growing stock volume × 100.
[3]Annual yield value divided by the growing stock value × 100.

yield table data for even-aged stands to uneven-aged forest conditions is misleading, inaccurate, and a waste of time. Comparison of the results of such an adaptation with any stand and stock table for an uneven-aged forest of the same species proves the inadequacy of the method. Meyer and Keller (*10*) conclude that in uneven-aged forests of upland oak on average and good sites a balanced growing stock volume of from 1,800 and 2,400 cubic feet should be maintained, and that these volumes are of about the same magnitude in both uneven and even-aged forests, although the distribution of volume by diameter classes is quite different. Walker (*17*), in comparing managed uneven-aged with managed even-aged upland oak forests, found that the uneven-aged form carries fewer trees per acre, a larger average diameter, a smaller growing stock volume in cubic feet, and a smaller yield in cubic feet. At the same time, the uneven-aged form shows a higher growing stock value, a higher yield value, and a slightly smaller percent return on investment. The results, by rotations in even-aged forests and by structural types in uneven-aged forests, are presented in Table 5.

The value aspect of the growing stock and the yield should have a tremendously important bearing upon the management of the growing stock of any forest. While it is not the purpose of this paper to discuss values in detail, it is nevertheless well to point out that regulatory measures based upon volumes only are weak substitutes for what a business manager seeks. Note that if we based our judgment of even- and uneven-aged forests upon volume production only, we would be inclined to call the even-aged form superior. Moreover, we might be led to believe that structural Type I with the lightest degree of stocking of the five types studies, is the superior producer of the uneven-aged forms. But when a value schedule is formulated for the growing stock in the different forest forms and structural types, we get some startling reversals. We must conclude that the higher proportion of large timber in the normal uneven-aged forest has a profound influence upon the value of the growing stock and the value of the yield, even though the large growing space occupied by individual overstory trees prevents a maximum cubic foot production per acre.

Summary

Accurate interpretations of the technical terms used in describing the forest growing stock are absolutely essential to the drawing of sound conditions regarding the distribution, volumes, and values of the growing stock.

For the unmanaged even-aged forest, summation of normal net yield table data provides the guide for computing a desirable growing stock volume.

For the managed even-aged forest, the desirable growing stock volume may be estimated by summation of data from the individual stand production over the period of a rotation. If sufficient experience data are available to show the reaction of even-aged stands of different ages and on varying sites to intermediate cuttings of differing intensities, such information may be synthesized to provide estimates of desirable growing stock volumes.

Growing stock volumes in managed forests (with reasonably good distributions of age classes or diameter classes) may vary within wide ranges without materially affecting the rate of gross production of wood volume. From the records presently available, it appears that volumes falling anywhere between 60 percent and 100 percent of those suggested in normal net yield tables may provide this maximum gross wood production in some of our most important commercial species. There are indications which point to the fact that some managed forests may actually carry greater growing stock volumes than those shown in net yield tables. It has already been shown, in the case of Douglas-fir and southern pines, that many unmanaged stands develop more volume than heretofore has been considered full stocking volume.

The actual stocking volume carried in a managed forest is the result of the application of sound silvicultural and economic principles. Its percentage relationship

with the volume suggested in a normal net yield table does not form a valid base for regulatory measures.

Uneven-aged forests support fewer trees and somewhat less cubic foot volume per acre than comparable even-aged forests. They also produce smaller yields per acre in cubic feet. They do, however, contain higher percentages of trees in the larger diameter classes, and as a result, the values of the growing stock and the values of the yield are higher than such values in even-aged forests.

The problem of regulation of growing stock volume cannot be solved satisfactorily until value schedules are worked out and financial yields are estimated for species or species groups in the forest.

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Volume of Treated Wood Increases During 1955

Volume of wood treated with preservatives in 1955 increased 3 percent over the preceding year, according to reports from 300 of 331 known wood-treating plants in the nation, the U. S. Department of Agriculture states.

In 1955 an estimated total of 258,180,350 cubic feet of poles, crossties, lumber, timbers, fence posts, piling, switch ties, crossarms, wood blocks, and the like were treated with preservatives. This compares to 250,662,697 cubic feet treated in 1954.

The volume of poles treated increased from 63,873,388 cubic feet in 1954 to 90,090,714 cubic feet in 1955. The volume of crossties, on the other hand, decreased from 105,529,303 cubic feet to 85,983,680 cubic feet.

The use of pentochlorophenol as a preservative increased 18 percent in 1955, from 8,340,997 pounds to 9,879,188 pounds. The use of creosote dropped 3 percent from 168,580,155 gallons in 1954 to 159,848,744 gallons in 1955.

Dwarfmistletoe Survey and Control on the Mescalero-Apache Reservation, New Mexico[1]

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PONDEROSA pine dwarfmistletoe (*Arceuthobium vaginatum* f. *cryptopodum* [Engelm.] Gill) is the most important disease agency affecting ponderosa pine (*Pinus ponderosa* var. *scopulorum* Engelm.) in Arizona and New Mexico (*1, 2, 3*). Douglas-fir dwarfmistletoe (*Arceuthobium douglasii* Engelm.) is also destructive in this region, although its host (*Pseudotsuga menziesii* [Mirb.] Franco), is a secondary species. Since 1950, regional interest in the dwarfmistletoe problem has been focused on the Mescalero-Apache Reservation of New Mexico, largely as a result of a challenging report prepared by Weaver and Sarlin.[4] The report revealed that mortality in cutover as well as virgin ponderosa pine stands was much greater than had been anticipated when the present management plan was adopted in 1940. The report also assembled evidence that dwarfmistletoe was the primary cause of these losses.

This article describes the impact of dwarfmistletoe on the productive capacity of the forests on the Reservation, as indicated by a damage-appraisal survey. It also gives the details of the steps that have been taken to reduce dwarfmistletoe to an innocuous level on one logging unit in the Reservation. These combined operations on the Mescalero are the first sustained attempt to evaluate and solve the dwarfmistletoe problem on an extensive forested area devoted primarily to timber production. Although the results are applicable only to the Reservation, they should serve to illustrate the nature of the problem in comparable areas and provide guide lines for future action.

Description of the Problem

The Mescalero-Apache Reservation covers a gross area of some 460,000 acres, about half of which is commercial forest land. Approximately 10 million board feet per year have been cut during the past decade. Ponderosa pine is the predominant commercial species, although some stands on the Reservation contain a high proportion of Douglas-fir and white fir (*Abies concolor* [Gord. and Glend.] Lindl.).

The virgin ponderosa pine stands are essentially two-storied in that mature and overmature trees rise above a dense understory of saplings and poles. Such two-storied stands offer optimum conditions for the development and spread of ponderosa pine dwarfmistletoe. It is not surprising, therefore, that the forest suffers severe losses from this parasite.

Although dwarfmistletoe had been noted on ponderosa pine on the Reservation for many years, it was not until the present management plan had been in effect for about 10 years that concern developed over the high mortality in residual stands after cutting. In the light of this heavy mortality, marking rules were modified in 1950 to provide for the cutting of all visibly dwarfmistletoe-infected ponderosa pines of merchantable size in regular timber sales. These heavier cuts, which were intended to anticipate future mortality and eliminate infection sources, necessitated a major revision in the management plan. Since an accurate appraisal of dwarfmistletoe damage was an important prerequisite to any revision, a cooperative survey was undertaken in 1952-53 by the Bureau of Indian Affairs and the Albuquerque, New Mexico, office of the Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering.[5] Early in the course of the survey the cooperators met with representatives of several branches of the Forest Service[6] and the Mescalero Tribal Council to consider the dwarfmistletoe problem on the Reservation. It was agreed that the survey was essential and should be continued but that in the meantime some form of direct control could be applied profitably to the understory in the Whitetail Logging Unit where heavily infected stands were being cut under the revised marking policy. As a result, control under the provisions of the Forest Pest Control Act was started in 1952.

[1]Appreciation is expressed to Lake S. Gill, Stuart R. Andrews, and Thomas E. Hinds of the Rocky Mountain Forest and Range Experiment Station for their help in planning and conducting the survey, in analyzing results, and in preparing this article. James M. Ruppelt, formerly of the Division of Forest Pathology, also assisted in the survey work.

[2]Forest Service, U. S. Department of Agriculture, with general headquarters at Colorado A & M College, Fort Collins, Colorado. The research reported herein was conducted from the Station's Forest Insect and Disease Laboratory at Albuquerque, New Mexico.

[3]Formerly forest manager, Mescalero-Apache Reservation, New Mexico. Views expressed here are those of the co-author and do not necessarily represent those of the Bureau of Indian Affairs.

[4]Weaver, Harold, and Reino R. Sarlin. The crisis in forest management on the Mescalero Indian Reservation. U. S. Indian Service Typewritten Report, 16 pp. plus illus. Oct. 17, 1950.

[5]Transferred to the Forest Service and now the Division of Forest Disease Research of the Rocky Mountain Forest and Range Experiment Station.

[6]The Lincoln National Forest, Division of Timber Management of the Washington Office, Southwestern Regional Office, and the former Southwestern Forest and Range Experiment Station.

Survey

The survey was designed primarily (1) to determine the abundance of dwarfmistletoe and the amount of damage it caused, and (2) to evaluate the control problem. Preliminary observations had indicated that, in addition to the ponderosa pine dwarfmistletoe, the Douglas-fir dwarfmistletoe might be causing heavy losses on the Reservation; therefore, the survey was planned to appraise the importance of both species.

Methods

Two north-south lines, one-half mile apart, were run through every section of commercial timberland on the Reservation, and the intensity of the two dwarfmistletoe species and the type of stand in two-chain intervals along the lines were recorded. In addition, 6 one-tenth acre circular plots per mile (12 per section) were established at random distances along each line. Each plot was classified according to forest type, elevation, aspect, degree of slope, and topographic position. Information collected on the plots included the species, d.b.h., log height, vigor (for ponderosa pine only), and degree of dwarfmistletoe infection[7] of each merchantable tree. Unmerchantable-sized trees more than 6 feet high classified either as large poles (trees 7.6 to 11.5 inches d.b.h.) or small poles (trees 6 feet high to 7.5 inches d.b.h.). Trees less than 6 feet were not recorded unless they were the only size class on the plot. The number of trees in each pole class was recorded by species and presence or absence of dwarfmistletoe. Infected ponderosa pine poles were also clalssified as prunable[8] or not prunable. Standing dead ponderosa pine and Douglas-fir poles were also recorded.

[7]Infected merchantable ponderosa pine and Douglas-fir were given a rating of one of 6 degrees of dwarfmistletoe infection determined by classifying each one-third of the crown as either 1 (light dwarfmistletoe) or 2 (heavy dwarfmistletoe) and adding the three figures; e.g., 6 = entire tree heavy.

[8]For purposes of the survey a prunable tree was one that had light dwarfmistletoe but none within 1 foot of the bole or above 17 feet, and, in addition, was silviculturally desirable for retention.

Results

The survey covered 334 sections or a gross area of 214,000 acres. Approximately 650 miles of strip were run and 4,013 sample plots (3,661 in commercial forest) were established. The proportion of the area sampled amounted to 0.2 percent. Mean values obtained for merchantable volumes of living trees and pole populations were within ± 10 percent (19 times out of 20) of the results that would have been obtained by a 100 percent survey. Sample means for mortality were ± 20 percent at the same odds.

Distribution of dwarfmistletoe.—Ponderosa pine dwarfmistletoe was found on 45 percent and Douglas-fir dwarfmistletoe on 13 percent of the forest plots; whereas the two species were found on 53 and 33 percent of the ponderosa pine and Douglas-fir type plots, respectively. A map showing the general incidence of ponderosa pine dwarfmistletoe on the Reservation is presented in Figure 1. As shown in this map the infected stands are generally distributed throughout the forest area. Ponderosa pine dwarfmistletoe undoubtedly occurs in all, and Douglas-fir dwarfmistletoe in at least three-fourths of the 334 sections surveyed. Of the 195,000 acres of commercial forest covered by the survey, ponderosa pine dwarfmistletoe was found on 88,000 acres and Douglas-fir dwarfmistletoe on 25,000 acres. The total infected area amounts to 103,000 acres, after allowance has been made for stands in which both dwarfmistletoes are present. The abundance of dwarfmistletoe varied greatly in the 21 management units into which the commercially forested parts of the Reservation are divided; infection ranged from 37 to 81 percent for ponderosa pine stands and from 10 to 57 percent for Douglas-fir stands.

Dwarfmistletoe in merchantable stands.—The Reservation stands covered by the survey had an average gross volume of 3,770 board feet per acre, 50 percent of which was in ponderosa pine, 26 percent in Douglas-fir, and the remaining 24 percent in white fir, Mexican

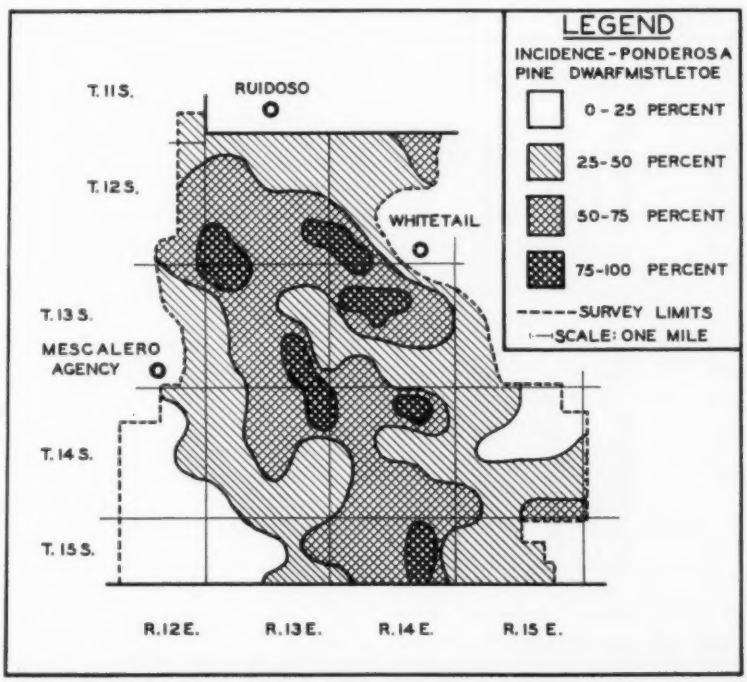

FIG. 1.—Incidence of ponderosa pine dwarfmistletoe on the Mescalero-Apache Reservation. The figures refer to percent of forest area (all forest types) in infected stands.

TABLE 1.—SUMMARY OF MERCHANTABLE STAND PER ACRE, GROSS VOLUMES IN DWARFMISTLETOE-INFECTED AND IN DEAD TREES (BASIS 3,661 PLOTS)

Species	Living trees: Total: Volume	Living trees: Total: Proportion of all species	Living trees: Infected: Volume	Living trees: Infected: Proportion of total volume	Dead standing trees with bark intact: Total: volume	Dead standing trees with bark intact: Total: Proportion [1]	Dead standing trees with bark intact: Infected: Volume	Dead standing trees with bark intact: Infected: Proportion [1]
	Bd. ft.	*Percent*	*Bd. ft.*	*Percent*	*Bd. ft.*	*Percent*	*Bd. ft.*	*Percent*
Ponderosa pine	1,880	50	700	37	240	11	130	6
Douglas-fir	970	26	250	25	90	9	50	5
White fir	720	19	0	0	[2]	—	—	—
Mexican white pine	200	5	0	0	[2]	—	—	—
Totals	3,770	100	[3]950	[3]25	[3]330	[3]8	[3]180	[3]4

[1]Based on gross volume of living and dead trees combined.
[2]Not recorded.
[3]Ponderosa pine and Douglas-fir only.

white pine (*Pinus flexilis* var. *reflexa* Engelm.) and spruce (*Picea engelmannii* Parry and *P. pungens* Engelm.) (Table 1). Thirty-seven percent of the merchantable ponderosa pine volume was in dwarfmistletoe-infected trees; the comparable figure for Douglas-fir was 25 percent.

Ponderosa pine mortality on the entire area from all causes was 11 percent of the living plus dead volume in merchantable-sized trees, while that for Douglas-fir was 9 percent. Estimated loss in board feet per acre per year is given in Figure 2. In deriving these estimates it was assumed that dead standing trees with bark intact represent the kill during the last 8 years. Although this method does not give precise results and probably is conservative, it does give estimates that are directly comparable for various stands. The ultimate damage caused by dwarfmistletoe in merchantable trees can be determined indirectly by comparing the mortality in infected and uninfected stands. For example, for ponderosa pine on cutover areas the mortality in infected stands was more than 3 times that in uninfected stands, and in virgin areas it was about 1.7 times greater (Fig. 2). Mortality in all ponderosa pine stands with dwarfmistletoe was 1.8 times the mortality in uninfected stands. Mortality in merchantable Douglas-fir in dwarfmistletoe-infected cutover areas was 4 times as heavy as in uninfected cutover areas and twice as heavy as that in uninfected virgin stands. Mortality in all Douglas-fir stands with dwarfmistletoe was nearly 4 times that in uninfected stands.

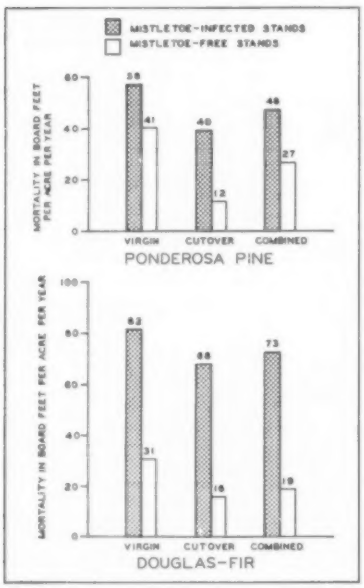

FIG. 2.—Mortality in board feet per acre per year by stand condition. *Upper*, ponderosa pine in the ponderosa pine type plots (basis: 2,464 plots). *Lower*, Douglas-fir in the Douglas-fir type plots basis: 979 plots).

These losses in merchantable ponderosa pine and Douglas-fir are directly correlated with intensity of dwarfmistletoe as is shown in Figure 3. The fact that evidence of dwarfmistletoe was found on 65 percent of the dead trees of both ponderosa pine and Douglas-fir whereas only 38 percent of the living ponderosa pines and 28 percent of the living Douglas-firs were infected further suggests that dwarfmistletoe was the primary factor contributing to the death of infected trees. The dwarfmistletoe rating in Figure 3 was determined by averaging the ratings of all merchantable-sized trees (both living and dead) on the plot.

A marked difference was found in the percentage of ponderosa pines of poor vigor[9] in dwarfmistletoe-infected and uninfected trees.

Twenty-two percent of the gross volume in infected trees was in poor-vigor trees but only 5 percent of those without dwarfmistletoe were so rated.

According to the survey 26 percent of the ponderosa pine poles on the Reservation are infected: 39 percent of the large poles and 25 percent of the small, or an average of 6 large and 58 small poles per acre. Seven percent of the poles in both size classes were classed as prunable. Extremely heavy infection (an incidence of 90 percent or higher) of small poles occurs on only about 9 percent of the forest area.

Infection of Douglas-fir poles in the Douglas-fir type amounted to 19 percent in large poles and 8 percent in small; the number of infected poles per acre in infected stands was 5 large and 32 small.

As in merchantable trees, mortality in both ponderosa pine and Douglas-fir poles was greater in stands with dwarfmistletoe than in uninfected stands, although the difference between dwarfmistletoe-infected and uninfected plots was much greater for Douglas-fir (Table 2). About 25 percent of the mortality in small ponderosa pine poles had resulted from fire, but this was a negligible factor in large-pole mortality. Mortality on dwarfmistletoe-free plots was heaviest in dense stands where natural suppression is an important cause of death, but on dwarfmistletoe-infected plots, mortality was greatest in stands of low density.

Control

Previous studies (*2*), as well as experience on the Reservation, have

[9]For purposes of the survey, merchantable ponderosa pines were classified as of good or poor vigor on the basis of crown color and density.

shown that a satisfactory level of control can be achieved only when treatment of the overstory is applied without compromise, because even lightly infected trees usually contain small or latent infections that are stimulated to profuse development when stands are opened up by logging. The pruning of infected branches has been found to be a costly method of elminating dwarfmistletoe from large trees, but it has some utility in understory treatment. To avoid the necessity of numerous re-examinations and retreatments of once pruned trees, however, this method was considered appropriate only for lightly infected trees in which few latent infections could be expected. Studies made in a heavily infected uneven-aged stand on the Fort Valley Experimental Forest at Flagstaff, Arizona, indicate that 2 cleanings spaced 5 years apart had, after 17 years, reduced the number of dwarfmistletoe infections to 7 percent of the pre-control population (*2*). Reduction in dwarfmistletoe seed production was much greater.

The original plan for dwarfmistletoe control in the Whitetail Unit consisted of three main phases to be carried out in the following order:

1. Logging of dwarfmistletoe-infected merchantable trees.
2. Direct control in infected understory.
3. Follow-up operations in both overstory and understory.

The first two operations have been completed in the Whitetail Logging Unit. Although the survey demonstrated that dwarfmistletoe is a serious problem in Douglas-fir on the Reservation as a whole, this host was known to make up such a small proportion of the stand on the Whitetail Unit that it was disregarded in the immediate control program.

It was recognized that the removal of dwarfmistletoe from the overstory is an indirect control measure, which can be provided for in timber sales contracts, except for follow-up operations in stands too scattered to be operable. On the other hand, it was evident that the application of direct control measures on Indian land would be handicapped by the fact that none of the timber sales receipts could be withheld for the improvement of residual stands. Furthermore, there was no local market for the infected saplings and poles that would be cut in the understory. In view of these limitations, direct control was financed with Forest Pest Control funds that were first made available in fiscal year 1953. Work started in November 1952 and continued until March 1955.

TABLE 2.—COMPARISON OF MORTALITY[1] IN POLE-SIZED TREES IN DWARFMISTLETOE-INFECTED AND UNINFECTED STANDS

Condition of plots	Dead ponderosa pine poles			Dead Douglas-fir poles		
	Large	Small	Combined	Large	Small	Combined
	Percent					
Uninfected	3	9	9	1	1	1
Infected	7	12	12	13	5	6

[1]Poles estimated to have died during the last 4-6 years, expressed as a percentage of the total number of living and dead poles.

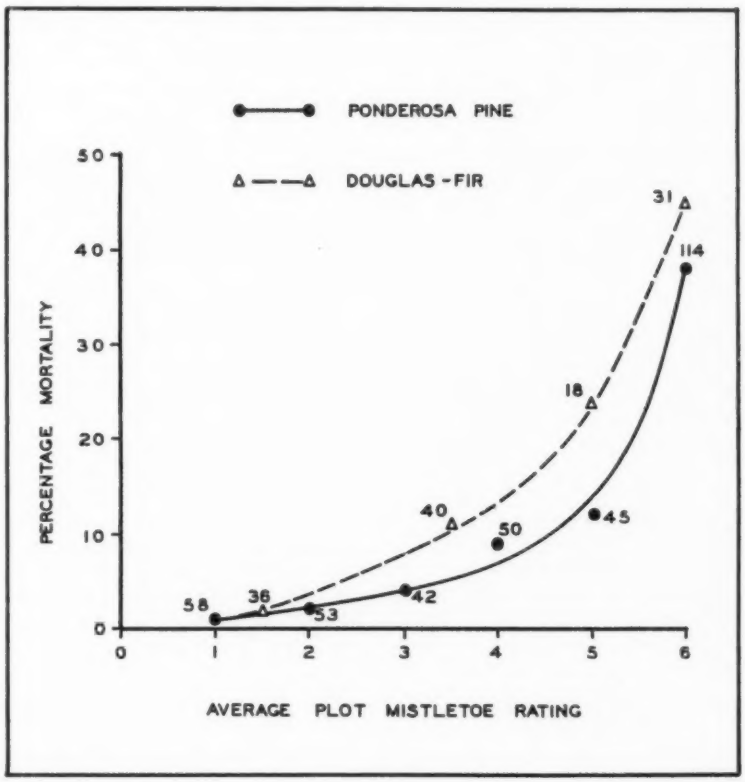

FIG. 3.—Percent mortality (dead as a proportion of living plus dead volume) in relation to average plot dwarfmistletoe rating of all standing merchantable trees. Virgin stands and stands cutover 21-30 years (basis: 362 ponderosa pine plots and 125 Douglas-fir plots).

Logging Dwarfmistletoe-Infected Merchantable Trees

Infection in overstory trees must be reduced to a minimum before control measures are applied to the understory. In practice it is not possible to mark every infected tree because light dwarfmistletoe infections high in the crowns of merchantable trees are difficult to detect from the ground even though marking is done only on sunny days. In addition, a few marked infected trees may be skipped by the felling crews. Missed trees usually

can be disposed of by small sales, provided sufficient volumes are involved for profitable operations; otherwise they must be felled, girdled, or poisoned.

The magnitude of this phase of control on the Mescalero and the variations likely to be encountered are indicated by some of the survey results. For example, the proportion of gross ponderosa pine volume in dwarfmistletoe-infected trees ranged from 19 to 62 percent in the different logging units, with an average of 37 percent for the entire area.

The dwarfmistletoe control area is located entirely within the Whitetail Logging Unit. This unit contains 16,000 acres of commercial forest land and had an estimated net volume of 51 million board feet of ponderosa pine in 1937. The first cutting was begun on the southern third of the unit in 1947 and removed about 50 percent of the merchantable ponderosa pine in that area. This heavy cut resulted from the fact that the Reservation marking rules were modified early in the sale to remove all infected trees. A "mistletoe-salvage" cutting was begun in 1953 on the northern two-thirds of the unit and, in addition, the southern third was logged a second time to remove trees that had developed infection since the first cutting and also those that were left as lightly infected early in the first sale. For the entire unit approximately 26 million board feet, or 51 percent of the 1937 cruise volume, was cut, yielding a revenue of $477,550 for the Tribal treasury.

Direct Control in the Understory

Operations in the understory started immediately after logging in some parts of the control area, while as much as a 3-year period separated the two phases in others. This variation resulted because it was practically impossible to cover the area in direct control as fast as it had been cut over during the timber sales. Results of studies at the Fort Valley Experimental Forest, Arizona, indicate that the length of time between removal of overstory trees and application of control to the understory could probably be extended to 10 years or more. In these studies of experimental control in a 30-year-old stand a 10-year period gave established infections ample time to become perceptible while new infection during the period was slight and practically limited to intensification on trees already infected (*2*). Before work was started the particular area to be covered was scouted and work lanes laid out; the width of the lanes averaged about 1 chain but varied with crew size, type of stand, and intensity of dwarfmistletoe. Several methods of marking trees for lane boundaries were tested including paint, tale or lime, and blazes, but blazing was the most rapid and satisfactory method.

The Mescalero-Apache Indians who made up the control crew were rapid and efficient in locating and treating infected trees. Although a certain amount of flexibility in crew organization permitted adjustment to changes in the intensity of the job, the optimum crew-size was about 10 men: 6 axemen, 3 chain-saw operators, and 1 foreman. The axemen preceded the sawyers along the work lanes and felled or pruned infected reproduction and poles up to about 4 or 5 inches d.b.h. Only lightly infected trees that could be pruned from the ground with an axe were pruned. Larger infected trees that had to be removed were blazed, and sometimes limbed for a short distance up the trunk to facilitate felling with chain saws. One axeman was assigned the additional job of blazing work lanes. In addition to supervising the work of the crew, the foreman checked treated areas for overlooked infections. Observations on two experimental plots within the control area indicate that more than 99 percent of the visible dwarfmistletoe infections were removed in the initial operation. Checks made in treated stands showed that 3 to 4 percent of the infected trees had been pruned.

All of the 12,000 acres within the control boundary were covered in the operation. Although dwarfmistletoe was not found on about one-third of the Whitetail Unit, the disease-free stands could not be blocked out because they were intermingled with the diseased ones.

Large accumulations of slash during the control operation were recognized as fire and insect hazards to the residual stands. Although deterioration of down material is sufficiently rapid on the Mescalero to reduce inflammability within a few years after cutting, slash in 100-foot strips along primary roads was piled and burned as a fire protection measure. The Forest Insect Laboratory[10] at Albuquerque, New Mexico, provided technical advice on insect problems, particularly on the threat to residual stands of *Ips* engraver beetles that had built up large populations in the slash. To minimize this threat it was suggested that control operations should be carried out continuously on large contiguous areas to provide a steady supply of cut green trees to attract the beetles. However it was recommended that heavy accumulations of slash should be avoided during the spring and early summer, and that limbs of felled trees should be lopped to expose the trunks to heating and rapid drying. To date insect-caused losses in the residual stands have been of little consequence and they do not appear to be any greater than those associated with normal logging operations.

Originally it was planned to limit direct control to lightly infected areas and to surround those that were heavily infected with chain-wide cleared isolation strips. This plan was abandoned because it was difficult to delimit centers of heavy infection; also, in the heavily infected areas a satisfactory stand remained after all visible infections had been eliminated. Consequently, control was applied to all infected stands regardless of the intensity of dwarfmistletoe.

A small sample (126 circular 0.01-acre plots on 270 acres) taken

[10]Transferred to the Forest Service in 1954 and now the Division of Forest Insect Research of the Rocky Mountain Forest and Range Experiment Station.

FIG. 4.—A part of the Whitetail Logging Unit showing a dwarfmistletoe-infected stand before and after control operations. Infection in this stand ranged from heavy in the foreground to light in the background. *Left*, April 1954, after logging infected overstory trees but before control in the understory. *Right*, same stand in June 1955, after completion of initial control in the understory.

in 1954 has provided an indication of the immediate effect of direct control in several such heavily infected stands in which treatment was severe (foreground in Fig. 4). More than 60 percent of the original trees remained after control, although the major proportion of the residual stand was in seedlings and saplings. Some areas, therefore, that previously had pole stands now support only the smaller size classes in adequate numbers. Control in the most heavily infected stands reduced the age of the predominant understory from 20-40 years to about 10-20. Since mortality figures from the survey show that mature stands cannot be anticipated on such areas so long as dwarfmistletoe is present, the reduction in the age and size of growing stock appears to be fully justified. The cost of the initial control work in fiscal year 1953 averaged $3.61 per acre. The cost during fiscal years 1954-55 amounted to $4.45 per acre; lopping of branches of downed trees was a routine measure during the latter period so this, in addition to increased wage rates, accounted for the higher per-acre costs. The cost of treatment for the entire area averaged $4.17 per acre. Axemen cut 370 trees per man-day and power saw operators cut 286. The average cost per tree was $0.03 for those cut by the axeman and $0.05 for those cut by the sawyers or an average of approximately $0.033 per tree for all trees treated.

Follow-up Treatments

Dwarfmistletoe infection either in the merchantable stand or in the understory cannot be reduced to an innocuous level in a single control operation. Follow-up work is needed to treat trees with latent infections, i.e., those in which dwarfmistletoe is already established but shoots have not yet been produced.

Approximately two-thirds of the control area has been cut strictly on a dwarfmistletoe salvage basis. Hence, uninfected trees that could be expected to survive for 10 years were left to make the second cutting of these stands economically feasible. In parts of the control area a high proportion of the infected overstory trees have been removed. The remaining work will involve girdling or poisoning of isolated trees rather than additional timber sales. A general second cleaning in the understory is also mandatory if the original investment in control is to be protected. The timing for this third or follow-up phase, which depends on such factors as stand age, original severity of infection, and thoroughness of initial cleaning, probably will be within 6-10 years after the first treatment. The optimum time to undertake the job will be determined from annual observations of dwarfmistletoe reoccurrence and development in representative stands within the control area. The second cleaning should be done when a maximum number of latent infections become perceptible but before a significant amount of reinfection occurs. It is particularly important that a thorough job of detecting and treating infected trees be done during the second cleaning.

Plans for the Future

Two permanent plots with a combined area of 35 acres have been established in the Whitetail Unit to provide some measure of the ultimate effect of direct control on productivity. The understory was treated by the control crew on one-half of each plot, the other half serving as a check. The overstory trees on both halves had been treated according to the marking policies developed during the timber sales on the Unit. Initial observations were made on about 14,000 plot trees of all sizes, and re-examinations will be made at 5-year intervals. Four additional permanent plots totalling 41 acres have been located in other logging units on the Reservation.

Extension of direct control to other parts of the Mescalero will depend to a large degree on the development of a market for small stems that would be cut. Early pilot plant tests for milled and treated fence posts were unsuccessful. However, the prospects are high for the establishment of a groundwood pulp mill near the Reservation. The mill would provide an outlet for trees down to about 4 inches d.b.h., and the only nonrevenue producing part of a control program would be the removal of infected trees of smaller size.

Summary

Ponderosa pine and Douglas-fir are severely infected by dwarfmistletoe on the Mescalero-Apache

Reservation of New Mexico. Most of the commercial forest land on the Reservation was covered by an extensive dwarfmistletoe survey during which more than 4,000 1/10-acre plots were established on about 214,000 acres.

Ponderosa pine dwarfmistletoe was present on 53 percent of the plots in the ponderosa pine type and Douglas-fir dwarfmistletoe on 33 percent of the plots in that type. Losses in ponderosa pine in cutover areas were three times greater in infected stands than in uninfected stands, and in virgin areas they were almost double. Douglas-fir mortality associated with dwarfmistletoe was somewhat heavier relatively in cutover stands but about the same as ponderosa pine in virgin areas. Both ponderosa pine and Douglas-fir losses were directly correlated with the intensity of dwarfmistletoe. At the the time of the survey, 22 percent of the infected merchantable ponderosa pines were rated as of poor vigor; whereas only 5 percent of the uninfected trees were similarly classified.

In the understory, dwarfmistletoe was found in 39 percent of the large ponderosa pine poles and in 25 percent of the small. Six percent of all Douglas-fir poles were inflected. Mortality in infected large-pole stands of both ponderosa pine and Douglas-fir exceeds one percent of the trees annually.

Control was applied to an area of about 12,000 acres in the Whitetail Logging Unit. All visibly infected merchantable trees were logged prior to the direct control operations in the understory. An Indian crew averaging about 10 men was then used for the control work, which consisted of felling or pruning all visibly infected ponderosa pine poles and saplings. The axemen cut an average of 370 trees per man-day (trees from seedling size up to about 4-5 inches d.b.h.) while the chain saw operators cut 286 per day (trees 5-12 inches d.b.h). The average cost for initial control was $4.17 per acre.

Follow-up operations in the control area will be necessary 6 to 10 years after the initial cleaning to treat trees with latent infections, i.e., those in which dwarfmistletoe is already established but shoots have not yet been produced.

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Coming Events

Northeastern Forest Tree Improvement Conference

A two-day summer meeting of the Fourth Northeastern Forest Tree Improvement Conference will be held at Johnsonburg, Pa., on August 7 and 8. Meetings will be held in the field and will center around discussions of the application of genetic concepts and methods to timber management.

Ernst J. Schreiner, c/o Morris Arboretum, Philadelphia 18, Pa., is executive secretary of the conference.

Allegheny Section Meeting

The Allegheny Section of the S.A.F. will hold its meeting in Ocean City, Md., September 6-7, 1956.

Canadian Forestry Association

The Canadian Forestry Association will hold a National Forestry Conference in Winnipeg, Ontario, Canada, September 17-19, 1956.

Society of American Foresters Annual Meeting

Annual meeting of the Society of American Foresters will be held in Memphis, Tenn. at the Peabody Hotel, October 14-17, 1956.

Effect of White-Tailed Deer on a Mature Northern Hardwood Forest

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In many Adirondack forests there is a poor stand of advance growth of the principal timber species. In many of these areas white-tailed deer *(Odocoileus virginianus)* are abundant and their browsing on both young trees and shrub growth is conspicuous. These two observations are sometimes put together to arrive at the suspicion that deer are responsible for a part—perhaps a considerable part—of the lack of vigorous regeneration. Foresters and wildlife managers generally assume that Adirondack deer populations will have to be reduced to ensure perpetuation of the forest.

This assumption is being tested on the Archer and Anna Huntington Wildlife Forest in the central Adirondacks near Newcomb, New York. Two deerproof exclosures were established in the fall of 1939 in a mature stand of northern hardwoods. This report is on the effect of deer on advance growth and shrubs in that mature stand for the 15 growing seasons from 1939 through 1954. In the spring of 1955 one of the exclosure areas was logged by cutting 50 percent of the basal area. Continued study will reveal the effect of deer on the young growth following logging.

Each exclosure is 150 by 600 feet (2.1 acres) surrounded by a heavy-gauge, open-mesh, woven-wire fence 10 feet high installed on cedar posts. The fences have been checked frequently and repaired when necessary. No evidence that deer gained access to the fenced areas has been found even though at times the wire was forced to the ground for short periods. It is possible that occasional deer have been inside the exclosures in the period, but the extent of their influence on the vegetation has been negligible. The effect of the fence itself on the vegetation (1) has been negligible because the exclosures are large and the wire mesh is so open.

Both exclosures are in a 1,694-acre stand of mature northern hardwood forest. When this stand was cruised in 1948 it contained nearly 7,000 board feet of timber per acre after deduction for cull (Table 1). Hard maple and yellow birch are the principal species with smaller amounts of beech, red spruce, and hemlock. This stand was probably cut over in the mid-nineteenth century for large softwoods, but all evidence of this logging has disappeared. This stand is quite typical of the northern hardwood type which has been thoroughly described by Eyre and Zillgitt (*2*). Beech is somewhat more abundant and yellow birch less abundant than in the typical stand they describe, but these differences are probably not significant.

The exclosures were established in areas where dominant and subdominant vegetation was characteristic of the entire stand and therefore a representative example of the mature Adirondack northern hardwood forest type. One exclosure is at an elevation of approximately 1,800 feet on a gentle northerly slope, and is within one-fourth mile of a heavily used winter deer concentration area. The second exclosure is at an elevation of approximately 1,950 feet, on a gentle northerly slope, and it is approximately one-half mile from the nearest winter deer concentration area.

The winter distribution of deer on this area has been reported by Webb (*5*). In periods of low temperature and deep snow the deer concentrate in areas of dense conifer cover, but in mild periods or in times when snow is light or crusted, the deer move out into hardwood-conifer and northern hardwood stands. The primary response of deer in periods of climatic extremes is to seek sheltered areas even though food conditions in these areas are poor. In milder periods deer leave the sheltered areas for forest types, such as northern hardwood, where food is more abundant. In the spring, summer, and fall deer are quite evenly distributed over the area.

Although the exclosure areas are not subject to the most intense deer use, they are quite heavily used at most seasons of the year. No part of the 15,000-acre Huntington Wildlife Forest has been open to deer hunting for more than 20 years and there are no effective deer predators. Although coyote, coyote-dog hybrids, and bobcats are present, there is no evidence that they limit the deer

TABLE 1.—AVERAGE TIMBER VOLUME OF STAND 38 (1,694 acres) IN 1948[1]

Species	Volume per acre—board feet (Doyle log rule)				Number of living trees per acre. D.b.h.—inches			
	Gross	Cull	Dead	Net	4	6	8	12 and up
Hard maple	4,381	393	229	3,759	7.5	5.5	6.1	21.5
Yellow birch	2,706	486	535	1,685	4.7	4.3	4.2	11.1
Beech	932	258	87	587	22.5	14.4	12.9	10.2
Red maple	24	2		22	0.9	0.9	0.7	0.3
Red spruce	455	24	17	414	8.5	7.4	6.4	4.8
Balsam fir	18		6	12	1.8	1.4	0.7	0.2
Hemlock	273	10	6	257	1.8	1.7	1.5	1.5
Other species	84	16		68	0.3	0.5	0.4	0.7
Total per acre	8,873	1,189	880	6,804	48.0	36.1	32.9	50.3

[1]Results of timber survey supervised by R. M. Hutchinson.

population level. Therefore, the deer population of the Huntington Wildlife Forest is believed to be at the carrying capacity of the forest environment. Deer drives on sample areas of the Huntington Wildlife Forest indicated a population of one per 15.4 acres in the fall of 1939 when the exclosures were established *(5)*. In the winter of 1946-1947 the deer population was found to be one per 29.0 acres *(4)*. From 1949 through 1954 the approximate deer population level has been determined by the pellet count method (*3*). These counts suggest that the deer population has fluctuated between 19.4 and 34.4 acres per deer in the period.

Except for deer, no browsing animals live in the area in significant numbers. Cottontail rabbits (*Sylvilagus* spp.) do not occur in the vicinity of the exclosures and snowshoe hares *(Lepus americanus)* are present only on rare excursions from distant habitats.

Both exclosure areas showed symptoms of apparent overbrowsing when the fences were established in 1939. Sugar maple seedlings were abundant on the ground, but very few exceeded eight inches in height. Witch hobble, the staple deer food of the area, showed signs of heavy browsing, and it seemed likely that its low vigor was due to excessive use by deer. No sample plots were established at the time the fences were installed in 1939 because it was expected that the differences between the vegetation inside and outside the exclosures would be obvious in a few years.

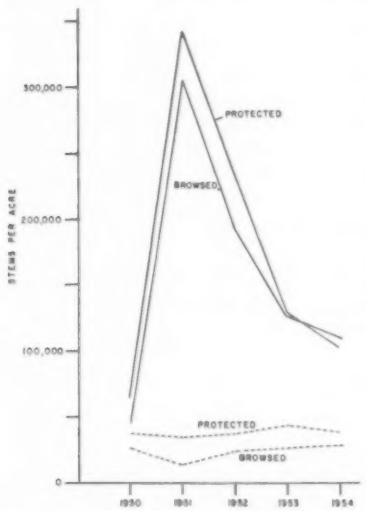

FIG. 1.—Number of hard maple stems per acre. Solid lines are total number, dotted lines are number five inches and more high.

Circumstances prevented close observation until 1950, when it was noted that there was only a slight difference between protected and browsed vegetation. Therefore, in 1950, when the vegetation had been protected for 11 growing seasons, sample plots were established inside both exclosures and in unfenced areas adjacent to the exclosures. It is assumed that if these plots had been established in 1939 there would have been no significant differences between vegetation inside and outside the exclosure fences. The sample plots are each one yard square, located in a grid pattern, with all four corners marked with permanent stakes. Twenty-four plots are located within each exclosure and another 24 are located outside each of the fenced areas. The number of stems of each species and the diameter (to the nearest millimeter) and height (to the nearest one-quarter inch) of each stem of woody vegetation have been determined on these plots each year from 1950 through 1954 (except that in 1951 only one of the exclosures was studied). Coverage and number of stems of herbaceous species have also been determined annually.

The results of these five annual measurements are summarized in Table 2. The difference between the vegetation inside and that outside in 1950 represents the cumulative effect of 11 years of protection from deer, while the data from 1954 indicates the cumulative effect of protection for 15 growing seasons.

Hard maple.—If deer have a significant effect on mature northern hardwood forests the effect should show most prominently on the reproduction and advance growth of hard maple. This species produces a large seed crop (Eyre and Zillgitt (*2*), record more than 8.5 million per acre), the seed germinates readily in the leaf litter, the seedlings persist for long periods under dense shade, and the buds and twigs are preferred deer browse. However, in both exclosures 15 years of protection from deer has produced only a slight response. Hard maple reproduction carpets the ground both inside and outside the exclosures with seedlings that barely come to shoetop height.

The number of hard maple stems was variable in the 1950-1954 period (Table 2 and Fig. 1), due largely to a heavy seed crop in 1950 or to favorable conditions for germination and seedling survival in 1951. Apparently such variation in number of stems is normal for this forest type and has no relation to deer influence since the same variation was exhibited inside and outside the exclosure fences. This annual fluctuation in number of hard maple stems is actually due to variation in number of seedlings-of-the-year, since the elimination of all stems below five inches in height results in a rather uniform count from year to year (Fig. 1).

The number of hard maple seedlings and advance growth is more than adequate to provide for a fully stocked stand. The lowest count (in 1950) was on the plots outside the exclosure fences when there was more than one stem per square foot of ground surface.

The effect of deer on number of hard maple seedlings is shown graphically in Figure 1. In 1950 when deer had been excluded from the exclosures for 11 growing seasons there were 27 percent less hard-maple stems outside the fenced areas. By 1953 the numbers of stems inside and outside the fences were almost identical, and in 1954, after deer had been excluded for 15 growing seasons, there were actually a few more hard maple outside the fence than there were inside. When the data for all years are used, the analysis of variance indicates that there is no significant difference between the number of hard maple stems where protected from deer and

TABLE 2.—EFFECT OF DEER ON WOODY VEGETATION LESS THAN SIX FEET IN HEIGHT AFTER 11 (1950) TO 15 (1954) YEARS OF PROTECTION FROM DEER BROWSING

Species		1950		1951[2]		1952		1953		1954	
		IN[2]	OUT[3]	IN[2]	OUT[3]	IN[2]	OUT[3]	IN[2]	OUT[3]	IN[2]	OUT[3]
Hard maple	Number per acre	62,617	45,677	340,217	306,942	232,319	193,902	127,655	126,646	101,236	107,992
Acer saccharum	Aver. ht. inches	7.90	6.65	3.80	3.27	4.67	3.97	5.95	4.45	6.04	4.58
	Aver. diam. mm.	2.10	2.03	1.11	1.04	1.26	1.14	1.66	1.36	1.53	1.21
Yellow birch	Number per acre	3,327	403	5,445	1,008	907	1,714	706	706	605	2,415
Betula lutea	Aver. ht. inches	2.11	1.94	0.50	2.25	4.92	2.04	5.21	3.96	6.21	2.15
	Aver. diam. mm.	0.48	1.25	0.00	1.00	1.56	1.29	1.86	1.43	2.17	1.17
Beech	Number per acre	5,042	3,731	2,420	8,873	8,167	9,277	3,832	6,453	3,227	3,832
Fagus grandifolia	Aver. ht. inches	9.02	13.24	14.88	5.12	8.78	8.93	9.79	8.75	13.59	9.27
	Aver. diam. mm.	2.64	3.59	3.58	1.23	1.93	2.13	2.76	2.45	3.34	2.76
White ash	Number per acre	907	1,109	6,252	1,210	1,109	1,412	807	1,311	504	1,311
Fraxinus americana	Aver. ht. inches	6.31	8.25	6.41	10.29	6.57	6.75	6.38	7.02	8.00	7.33
	Aver. diam. mm.	2.33	2.73	1.45	2.83	2.36	2.07	3.13	2.38	2.60	2.54
Witch hobble	Number per acre	4,437	2,924	11,092	8,672	7,663	5,647	7,058	5,042	6,252	5,243
Viburnum alnifolium	Aver. ht. inches	11.13	13.14	9.24	13.09	11.53	13.83	12.57	13.69	12.03	15.71
	Aver. diam. mm.	3.07	3.95	2.60	4.05	2.96	3.50	3.51	4.14	3.48	4.25
Honeysuckle	Number per acre	2,117	3,327	1,613	202	2,017	2,924	1,815	3,126		
Lonicera canadensis	Aver. ht. inches	13.35	5.93	——	8.00	9.43	6.70	8.22	7.26		
	Aver. diam. mm.	3.40	1.96	——	5.00	2.07	1.72	2.69	1.90		
Striped maple	Number per acre	4,941	3,428	1,412	1,412	4,134	4,537	3,227	3,327	4,840	4,033
Acer pensylvanicum	Aver. ht. inches	7.75	4.63	9.75	3.61	8.41	4.17	10.46	4.77	7.83	4.83
	Aver. diam. mm.	2.14	1.79	2.71	1.14	2.66	1.42	3.72	1.76	2.46	1.70
Red maple	Number per acre					202	202			101	202
Acer rubrum	Aver. ht. inches					7.25	4.13			11.00	2.50
	Aver. diam. mm.					1.50	1.00			2.00	1.00
Mountain maple	Number per acre					101	0	101	0	302	101
Acer spicatum	Aver. ht. inches					8.50	——	9.00	——	5.25	2.00
	Aver. diam. mm.					2.00	——	2.00	——	1.67	1.00
Red spruce	Number per acre	101	202	202	0	101	101	202	0	101	101
Picea rubra	Aver. ht. inches	11.50	3.13	11.00	——	13.75	1.00	7.75	——	17.00	1.75
	Aver. diam. mm.	4.00	1.50	5.00	——	6.00	1.00	3.50	——	6.00	1.00
Hemlock	Number per acre	0	101	0	202	0	101	101	202		
Taxus canadensis	Aver. ht. inches	——	1.75	——	2.75	——	2.00	2.00	1.25		
	Aver. diam. mm.	——	1.00	——	1.00	——	1.00	1.00	1.00		

[1]Based on one of the two exclosures.
[2]Data from plots within the exclosures.
[3]Data from plots subject to deer browsing.

where subject to deer browsing.

Even if the difference in number of stems were statistically significant, it is doubtful if the deer effect could have been considered important from a forest management point of view. There was adequate regeneration of the species and the deer effect was not great enough in any year to have raised a reasonable question of whether deer browsing would limit the future stand.

The average height of hard-maple stems (Fig. 2) varied inversely with the average number of stems (Fig. 1) in a predictable manner. The average stem length was consistently lower where browsed by deer. That difference was greatest in 1953 when the average height of stems outside the exclosure was 4.45 inches, while the average height of protected stems was 5.95 inches. The 1.5-inch difference between these measurements is statistically significant, but since it represents the cumulative effect of 14 years of deer browsing there is real doubt as to its importance.

The total amount of hard maple browse available to deer is extremely variable between years. When average number of stems and average height are multiplied to get a measure of total stem length per acre, it is found that the 1951 "standing crop" was more than twice that of 1950 or 1954. These figures also show a declining trend in the difference between total stem length inside and outside the exclosures:

Year	*Difference between stem length inside and outside exclosures expressed as a percentage of that inside*
1950	38.6
1951	22.4
1952	29.0
1953	25.8
1954	19.1

If this trend continued there would be no difference in stem length inside and outside the exclosures by 1959.

Below the 10-to-15-inch height class deer do not have a significant effect on height distribution of hard-maple advance growth (Fig. 3). There are large numbers of individual stems of small size, and deer browsing does not influence them. However, there is a considerably greater number of taller individuals inside the exclosures than outside. There are less than half as many stems from 10 to 20 inches in height outside the fences as there are inside and less than one-tenth as many stems 20 inches and above where browsed by deer (Table 3). Apparently deer affect only the occasional tall stems which extend above snow line in winter.

Interpretation is complicated by the fact that from 1950 through 1954 the number of stems in the various height classes remained relatively constant (Table 3 and Fig. 3). Lack of trends both inside and outside the exclosures is confirmed by the *t* test, which proved that regression coefficients might have been zero. We believe that protection from deer in the first 11 growing seasons brought about the release of a few stems. In the 1951 through 1954 growing seasons there was no further change in height distribution. It seems likely that root competition or other environmental factors then held the advance growth in equilibrium.

The importance of the differences in height distribution in forest management must be questioned even though there is no question of their existence in a statistical sense. After 15 years of protection from deer the tallest hard-maple stem measured inside the exclosures was only 38 inches, while on an equal area outside the fence there were three stems 24 inches tall. Since the complete elimination of deer browsing did not produce a vigorous advance growth of hard maple after 15 years, it is clear that deer played

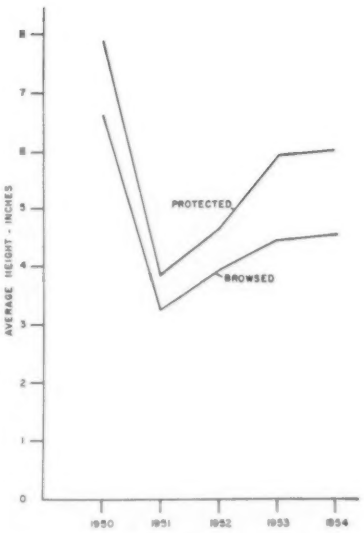

FIG. 2.—Average height of hard maple advance growth.

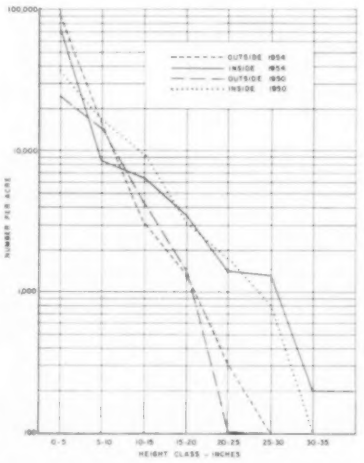

FIG. 3.—Number of hard maple stems by five-inch height classes. Protected stems are listed as inside, while browsed stems are listed as outside.

TABLE 3.—STEMS OF HARD MAPLE ADVANCE GROWTH PER ACRE IN THE TALLER HEIGHT CLASSES

	Height class 10 to 19 ¾ inches		Height class 20 inches and above	
	Inside	*Outside*	*Inside*	*Outside*
1950	12,449	6,451	3,024	403
1951[1]	10,287	1,815	1,815	202
1952	14,011	5,746	5,040	202
1953	13,910	5,241	4,234	202
1954	9,576	5,645	3,629	302
Average	12,047	4,980	3,548	262

[1]Based on one exclosure.

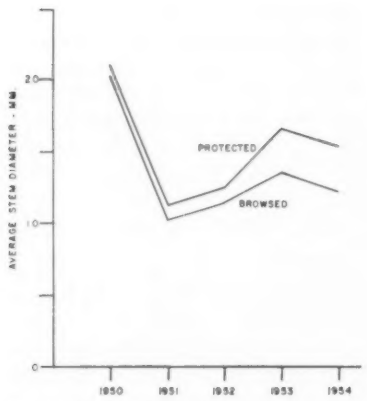

FIG. 4.—Average ground-level diameter of hard maple advance growth.

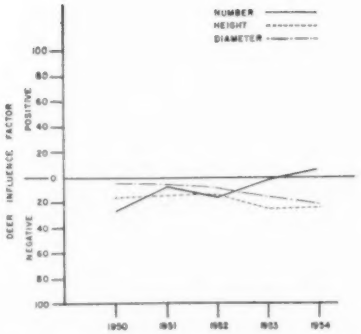

FIG. 5.—Deer influence factors for hard maple advance growth. See text for explanation.

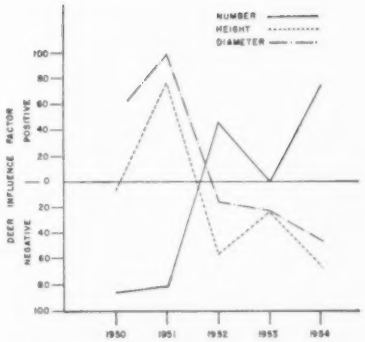

FIG. 6—Deer influence factors for yellow birch advance growth. See text under hard maple for explanation.

a relatively minor role in the complex of factors which control the growth of the species.

The average diameter of the hard-maple stems subject to deer browsing is consistently smaller than those protected from deer (Table 2 and Fig. 4). After 11 years of protection (1950) the difference was slight, but it became proportionately greater until by the fifteenth year the average stem diameter outside the exclosures was more than 20 percent smaller than that inside. The importance of this difference must also be questioned from a forest management point of view. In 1954 the difference in diameter was less than one-third of a millimeter or 12 one-thousandths of an inch. This small difference is not likely to affect the vigor of the future forest stand.

The effect of deer browsing on hard maple may be summarized by calculation of what is called "deer influence factor." This is the difference between the average measurement inside the exclosure and the average outside, divided by the largest of these averages. A deer influence factor of zero suggests that deer do not influence that measurement. A negative deer influence factor indicates that deer were removing part of the vegetation, while a positive factor suggests that deer browsing or deer disturbance is increasing the number of stems or size of the plants. A positive deer influence factor may seem absurd, but it is conceivable that pruning, for example, may result in greater height growth or that deer pawing in the leaf litter may result in a more satisfactory seedbed and in more seedlings becoming established in mineral soil.

The deer influence factors for hard maple are presented in Figure 5. In 1950 (after 11 years of protection) there was a reduced number of seedlings outside the exclosures, but in the following five years that effect was gradually eliminated. Height and diameter were reduced by deer activity and this influence was increased slightly in the period from 1950 through 1954.

Yellow birch.—Yellow birch, at present, is the most valuable Adirondack hardwood species. In a good year this species may produce more than 2,700,000 seed per acre (*2*). However, in dense mature stands little advance growth is expected because yellow birch needs moist mineral soil for seedling establishment and considerable light for vigorous growth. There is no indication that elimination of deer browsing will modify these species requirements. After 15 years of protection there were only two stems of yellow birch over 10 inches tall on the plots inside the exclosures, while there was one stem over 10 inches on the plots outside the fences.

The number of seedlings established fluctuated considerably between years (Table 2) and apparently was governed by local conditions such as leaf litter and depth and exposure of mineral soil. The deer influence factors seem to follow a rather consistent trend from 1950 through 1954 (Fig. 6). After 11 years of protection deer seemed to be limiting the number of seedlings, but five years later deer activity seemed to favor establishment of the species. It is likely that deer are neutral in their effect, and the changes merely indicate variations in local conditions. Deer influence on height and diameter is inverse to their effect on number of seedlings. Since there is not a vigorous stand of reproduction after 15 years of protection it must be concluded that deer influence on yellow birch is not important in a dense mature stand.

Beech.—The second most abundant tree species in terms of number of seedlings per acre is beech. This species is definitely not a deer browse plant, since there is seldom any evidence that deer browse it. However, beechnuts are a preferred fall food, and deer may influence the species by consuming seed. Examination of Table 2 will indicate that deer are not limiting establishment of beech, in fact, their activity seems to result in the establishment of more beech since the deer influence factor is positive in four of the five years (Fig. 7). The height and diameter factors vary around zero and probably indicate that deer do not in-

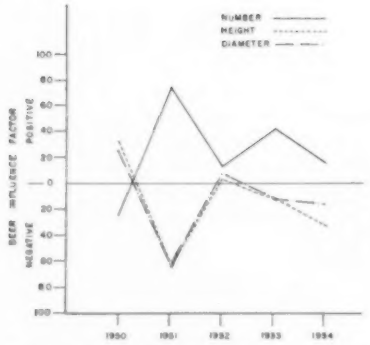

FIG. 7.—Deer influence factors for advance growth beech. See text under hard maple for explanation.

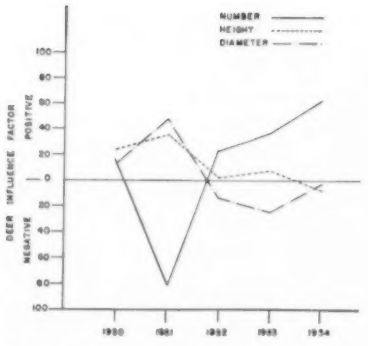

FIG. 8.—Deer influence factors for white ash advance growth. See text under hard maple for explanation.

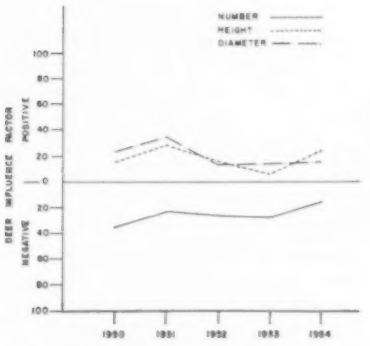

FIG. 9.—Deer influence factors for witch hobble. See text under hard maple for explanation.

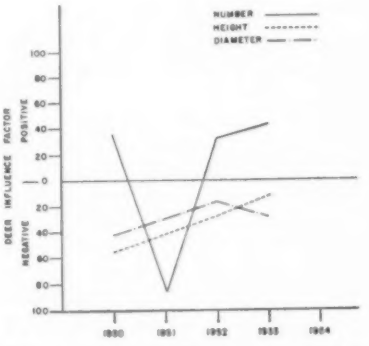

FIG. 10. — Deer influence factors for honeysuckle. See text under hard maple for explanation.

fluence the growth or vigor of the species significantly.

White ash.—Vigorous advance growth of white ash is not expected in dense old-growth stands. In this stand, however, there is a considerable amount of white ash reproduction averaging six to 10 inches in height. Field examination indicates that most of these stems are slow-growing individuals, many of which became established five or more years earlier.

The effect of deer is apparently to increase the number of stems (Table 2 and Fig. 8). This may be due to deer pawing the leaf litter and exposing mineral soil, which is a more suitable ash seedbed. Deer effect on height and diameter is apparently not great, but even in these respects the stems subject to deer influence apparently tend to be larger than those protected from deer. In four of the five years the average height was greater outside the exclosures than inside. The tallest white ash (23 inches) was found on a plot outside the exclosure after 15 years of protection, and it was nearly twice as tall as the tallest stem talied on the plots inside the fences (12 inches).

Witch hobble.—Witch hobble is, without doubt, the staple winter deer food of the central Adirondack region. In many areas the species shows obvious signs of heavy use and apparent signs of over use, since the stems are stag-topped and vigor is low. The witch hobble in the exclosure areas seemed to show unmistakable signs of overbrowsing in 1939. It was reasonable to expect that it would show a drastic and rapid response to protection from deer. However, after 15 years of such protection there is no sharp difference in appearance or vigor inside or outside the exclosure fence. The number of stems outside the fences is consistently lower for the five years when measurements were made, but height and diameter were consistently higher (Fig. 9).

There is no indication that the removal of all deer browsing for 15 years has resulted in a significant change in the vigor of witch hobble. Most stems inside the exclosure look as "overbrowsed" as the stems outside the exclosures. There is certainly little difference in the amount of deer food available each year. If the number of stems per acre is multiplied by the average height of the stems to get a total stem length per acre there is only a slight indication that deer removed any witch hobble (Table 4).

Honeysuckle. — Honeysuckle is present in considerable number in the northern hardwood type, but few plants are vigorous. Since it is a highly palatable deer browse species it seems logical to suspect that deer are in part responsible for the low vigor. However, after many years of protection from deer there is no suggestion of significant increase in vigor. The number of stems is actually greater where subject to deer browsing (Fig. 10), although height and diameter were decreased. Even after 14 years of protection the average height was less than 10 inches. The tallest stem measured inside the exclosure was 20 inches, while the tallest stem outside was 16.5 inches.

Striped maple.—Striped maple is a highly palatable deer browse but one that needs greater light than filters through the dense growth of the mature forest. However, considerable numbers of individuals become established and grow slowly in spite of the adverse conditions. Deer apparently do not affect the number of stems, but they reduce the average height and diameter of the advance growth (Fig. 11). The average height did not exceed 10.5 inches even after 15 years of protection. The tallest stem inside the fences was 23.5

inches in contrast to the tallest stem outside, which measured 19 inches. It seems safe to conclude that deer do influence the growth of striped maple to a small extent, but they are not the factor which significantly reduces the vigor of the species in dense mature stands

Herbaceous vegetation. — Deer also appear to influence the herbaceous vegetation of their environment, probably by summer browsing and disturbance such as pawing. The data from the 1954 check of the yard-square plots are given in summary form in Table 5. Five species may have been reduced in quantity by deer browsing: partridgeberry, wood fern, starflower, bishop's-cap, and twisted-talk. Of these five, only wood fern shows a significant response. The number of fronds inside the exclosures was more than doubled and the coverage was more than one-third-higher. Deer are known to eat woodfern rhizomes in the fall. Four herbaceous species seem to increase in quantity when subject to deer influence: Trillium, violet, dewberry, and jack-in-the-pupit. Of these, only violet shows a significant change in abundance. Where deer were present, violet covered more than three times as much area and there were considerably more stems.

Grouping all herbaceous species together suggests that while deer may influence some species their total effect is neutral. These data show that areas browsed by deer have fewer stems but that coverage is greater.

Summary

Two deer exlosure areas were established on the Archer and Anna Huntington Wildlife Forest near Newcomb, New York in the fall of 1939. Each of the fenced areas enclosed slightly more than two acres. Both areas are in an extensive stand of dense mature Adirondack northern hardwood forest where there was evidence of deer pressure on the advance growth of trees and on shrub growth. At the time these fences were erected it was believed that deer were in large part responsible for the lack of vigorous advance growth of such species as hard maple.

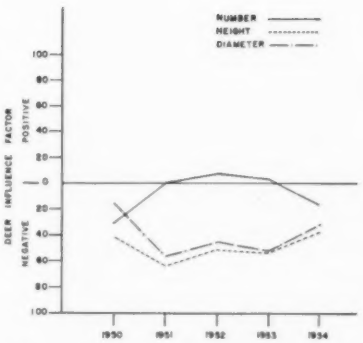

FIG. 11. — Deer influence factors for striped maple. See text under hard maple for explanation.

No sample plots were established when the fences were erected because it was believed the differences in vegetation inside and outside the exclosures would be so obvious in a few years that the effect of deer would be apparent from inspection. During the war years few observations were possible and the only work done was maintenance of the fences. In 1950 sample plots were established inside and outside the fenced areas because after 11 growing seasons of deer exclusion there was very little apparent difference These sample plots have been checked for five consecutive years to determine the species response to protection.

Hard maple reproduction is so abundant both inside and outside the exclosure fences that there is no question as to whether this species will be represented in the future stand. Deer apparently reduce the number of stems to some extent but not enough to influence future stand composition. Deer also reduce average height and diameter of hard maple, but even after 15

TABLE 4.—EFFECT OF DEER ON TOTAL PRODUCTION OF WITCH HOBBLE MEASURED BY THE COMBINATION OF NUMBER PER ACRE MULTIPLIED BY AVERAGE HEIGHT

Year	Total stem length—inches		Deer influence factor
	Inside	Outside	
1950	49,383	38,421	–22.2
1951	102,490	113,516	9.7
1952	88,354	78,098	–11.6
1953	88,719	69,025	–22.2
1954	75,212	82,368	8.7
Average	80,832	76,286	–5.6

TABLE 5.—EFFECT OF DEER ON HERBACEOUS VEGETATION. DATA FROM 1954, AFTER 15 YEARS OF PROTECTION

	Number of stems per 0.01 acre		Deer influence factor	Coverage percent		Deer influence factor
	Inside	Outside		Inside	Outside	
Partridgeberry *Mitchella repens*	86	7	—92	1.2	0.2	—83
Wood fern *Dryopteris intermedia*	134	61	—54	24.2	15.8	—34
False lily *Maianthemum canadense*	6	3	—50	0.1	0.1	0
Starflower *Trientalis borealis*	30	17	—43	1.7	1.5	—12
Bishop's-cap *Mitella nuda*	95	57	—39	5.8	4.6	—21
Wood sorrel *Oxalis montana*	241	158	—34	3.1	12.3	+75
Club moss *Lycopodium* spp.	388	266	—31	9.4	11.2	+17
Twisted stalk *Streptopus roseus*	9	7	—22	1.5	0.8	—43
Trillium *T. erectum, T. undulatum*	19	24	+21	0.8	1.0	+20
Violet *Viola* spp.	108	150	+28	5.0	17.5	+71
Dewberry *Rubus acaulis*	3	17	+82	0.6	1.7	+62
Jack-in-the-pulpit *Arisaema triphyllum*	0	4	+100	0	0.2	+100
Total	1,119	771	—31	53.4	66.9	+20

years of protection there is no important increase in average size of stems. The greatest deer influence was their effect on height distribution. After 15 years of protection there were more tall stems inside the fence. Even though this difference is significant statistically there is real doubt as to its importance in forest management. The protected stems were taller by a few inches but they showed no sign of increasing in vigor to the point where they constitute a rapidly growing segment of the forest community.

Yellow birch and white ash reproduction is not expected to succeed under a dense canopy, and deer apparently have no effect on the growth of these species. However, deer activity may increase the number of stems of both species, perhaps through trampling the seed or exposure of mineral soil seedbeds by pawing. Beech growth is not affected by deer because it is seldom browsed, but deer activity may result in the establishment of more beech, perhaps because they trample the large, heavy seed into the mineral soil.

Three species of deciduous shrubs are important in deer management because they provide the bulk of the winter food of deer. Witch hobble is the staple winter food species of the region. It was apparently overbrowsed when the fences were established in 1939, but after 15 years of protection it showed little or no increase in vigor. The number of stems is apparently reduced by deer activity, but growth of the residual stems is greater, so there is little net effect. There is a slight reduction in total amount of deer food on the unprotected areas, but that food is more available in critical periods since it is taller and extends further above the snow. Honeysuckle is quite abundant, but 15 years of protection has not produced vigorous growth. The effect of deer on the number, height, and diameter is the opposite of that found for witch hobble. Number of stems is increased but average height and diameter are decreased inside the exclosures. Striped maple is a species which requires an open canopy for vigorous growth but those stems which do become established in a dense stand are reduced in height and diameter by deer browsing.

Deer also influence the herbaceous vegetation of their environment to some extent, probably by summer browsing and disturbances of leaf litter and soil. Wood-fern rhizomes are a common fall food and the number and coverage of this species are reduced outside the exclosures. Violet is apparently increased in abundance where influenced by deer.

The difference between the vegetation inside and outside the exclosures must be evaluated in terms of the effect of a carrying-capacity deer population on the forest vegetation. After 15 years of protection it can only be concluded that deer are not an *important* limiting factor in the establishment of any tree, shrub or herbaceous species in this uncut mature northern hardwood forest. The effect of deer can be measured after 15 years, but the differences are so small as to be unimportant in the management of the mature Adirondack northern hardwood forest.

One of the exclosure areas was logged in 1955 to determine the effect of deer following the opening of the canopy.

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Home Treatment for Fence Posts Developed

The Forest Products Laboratory, Madison, Wis., according to a U. S. Department of Agriculture release, has developed a new simple method of treating fence posts against decay and termites.

By standing round green posts first in a water solution of copper sulfate and then a water solution of sodium chromate, a diffusion of the two chemicals is attained to form copper chromate. This is toxic to fungi and insects, practically insoluble in water, and will not leach from wood placed in damp soil. Hardwood or pine may be treated. Of 100 pine posts thus treated and set in 1942 in Mississippi one has decayed. Average life of untreated posts in the area is about three years.

Farmers and homeowners may secure details of the treatment from the Forest Products Laboratory, U. S. Forest Service, Madison, Wis.

Notes

Effect of Living Shade on House Temperatures

Dense shade from trees can reduce room temperature in houses as much as 20F.

Studies conducted during the summer of 1954 showed that the cooling influence of well placed shade trees of moderately dense foliage can materially affect both exterior and interior living areas, even in hot regions where temperatures reach above 100F.

To carry out the experiments, a 20 by 8 foot house trailer was selected because of its adaptability to changes in site and orientation. The trailer simulated—as nearly as possible—a typical low-cost frame house. Construction included 2 by 3 inch studs with the clapboard siding painted white and the roof covered with asphalt shingles. There was so little insulation in walls and roof that it had slight effect. The window area of the interior space used in testing totaled 576 square inches of glass on the right side, none on the left side where the instrument room shut off the test room, 899 on the front, and 1,152 square inches on the rear. Roof overhang was negligible and offered little shading.

The results obtained from the trailer experiments can be applied only to small wood houses with wood floors over a crawl space. Houses built on slab floors have a very different heat capacity than those not directly connected with the ground. Because the ground is a large thermal source or sink, it has a great bearing on room temperatures. Heavy materials take longer to warm up and consequently longer to cool off. For that reason, a wood-type structure heats up and also cools off more rapidly than masonry or stone. The square footage of the slab and cubic volume of a house are also important. Furnishings—5,000 pounds for the average home—add considerably to the heat capacity of a house. The removal of a small amount of heat from a small house may have a great deal of effect upon the cooling, but in a large house it may be unnoticeable.

Three experimental sites for the house trailer were selected for comparing the effectiveness of the different types of shaded situations with bare, unlandscaped ground. At each site, the trailer was located with its long axis running east and west. Half-hour readings were taken of wet and dry bulb thermometers, and recordings of temperatures were made from thermocouples located at the following points: on the roof, ceiling, floor inside and out; east wall outside, south wall inside and out, west wall inside and out, and the north side inside and out.

Site A—a bare dry ground area devoid of all vegetation and shade during the day—was selected as the check site because it was typical of many locations of new small homes.

Site B—east of and adjacent to a large grove of eucalyptus trees—was chosen because it provided afternoon shade only. A good cover of turf was present on all sides.

Site C—beneath a group of large fig trees—was selected be-

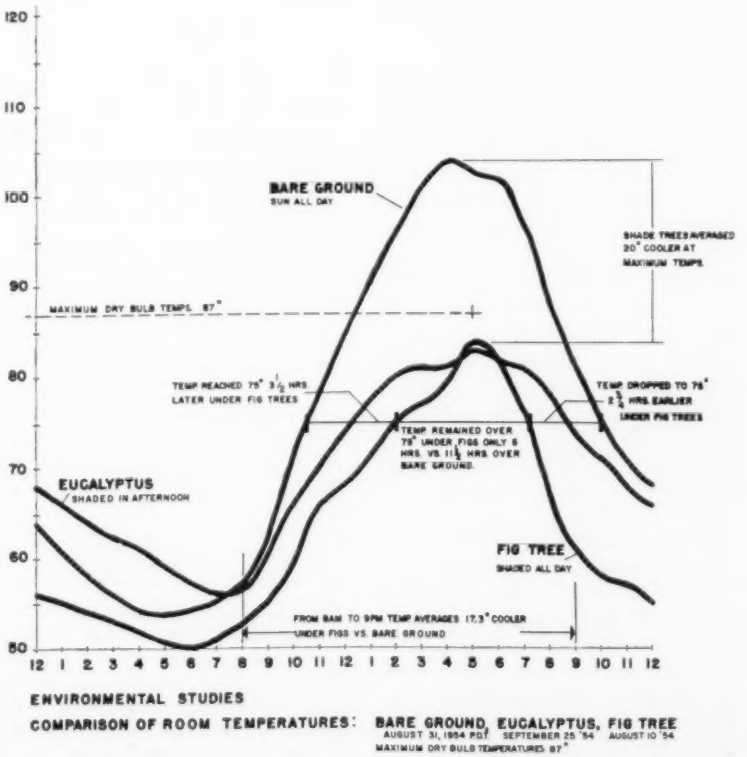
120
110
100
90
80
70
60
50
BARE GROUND
SUN ALL DAY
SHADE TREES AVERAGED 20° COOLER AT MAXIMUM TEMPS.
MAXIMUM DRY BULB TEMPS. 87°
TEMP REACHED 75° 3 1/2 HRS. LATER UNDER FIG TREES
TEMP DROPPED TO 75° 2 3/4 HRS. EARLIER UNDER FIG TREES
TEMP REMAINED OVER 75° UNDER FIGS ONLY 5 HRS. VS. 11 1/2 HRS. OVER BARE GROUND
EUCALYPTUS
SHADED IN AFTERNOON
FIG TREE
SHADED ALL DAY
FROM 8AM TO 9PM TEMP AVERAGES 17.3° COOLER UNDER FIGS VS. BARE GROUND
12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
ENVIRONMENTAL STUDIES
COMPARISON OF ROOM TEMPERATURES: BARE GROUND, EUCALYPTUS, FIG TREE
AUGUST 31, 1954 P.D.T. SEPTEMBER 25 '54 AUGUST 10 '54
MAXIMUM DRY BULB TEMPERATURES 87°

FIG 1.—Comparisons of room temperatures of the three situations. Bare Ground, August 31, 1954, P.D.T.; Eucalyptus, September 25, 1954; and Fig Tree, August 10, 1954.

[1]This progress report is based on California Agricultural Experiment Station Research Project No. 1536, Western Regional Project W-8 with Departments of Home Economics, Landscape Management, and Agricultural Engineering, University of California, Davis, cooperating.

Published through courtesy of The Division of Agricultural Sciences, University of California.

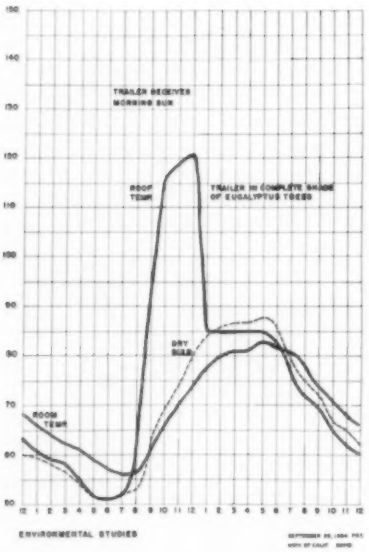

FIG. 2.—Effect of afternoon shade is shown in the roof temperature readings where unit is located east of eucalyptus group.

cause the foliage completely covered the trailer with the exception of the north side, yet no direct sunlight struck any part of the structure. A good turf was located adjacent to the north.

Comparisons of the temperatures recorded at Site A, on August 31; Site B, on September 25; and Site C, on August 10 are given in Figure 1 because conditions of wind, temperatures, and humidity were approximately equal. However, the summer of 1954 was unusually cool and maximum temperatures were considerably below those of normal years.

More important than the 20F temperature differential between bare ground and shade is the resulting delaying action of the morning heating and hastening of the afternoon cooling. Under the fig trees—Site C—the morning temperature reached 75F, three and one-half hours later than when the trailer was located in the sun—Site A. It cooled down to 75F in the afternoon, two and three-quarter hours earlier than in the open. In addition, the temperature remained over 75F during the hot noon period only five hours in comparison to the eleven and one-half hours at Site A—the bare ground check location.

The effect of afternoon shade from the eucalyptus trees—Site B—was striking, as indicated by the readings of roof temperatures (Fig. 2). The trailer received direct sun until 12 noon; then as the shade began to cover the roof, a 35F drop in roof temperatures occurred in an hour's time after arrival of the shadow. The interior heating continued to rise but began to level off two hours later.

Although the coolest condition existed beneath the fig tree foliage—Site C—there was inadequate light inside for reading and close work. However, this is attributed largely to the smallness of window area.

From the results of these tests, it would appear that the best planting for living shade would be high-branching deciduous trees—relatively close to the house on the east and south—because vertical shade control is necessary during the morning and afternoon. Low-branching trees planted on the west and northwest would provide shade in late afternoon and early evening. Such plantings would provide good cooling shade during the entire day.

By planning deciduous trees on the east and south, the benefit of the sun could be had in winter when the trees have dropped the leaves. Evergreen trees—broad-leafed or conifer—on the west or northwest would not interfere with the winter sun but would provide green foliage and protection from the winter winds.

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More than 33 million cords of pulpwood were consumed in the United States in 1955, setting an all-time peak, as the per capita use of paper and paperboard reached a new high of 415 pounds, according to W. S. Bromley, executive secretary of the American Pulpwood Association.

Durability of Alabama-Grown Arizona Cypress

Arizona cypress (*Cupressus arizonica* Greene) is becoming widely distributed in Alabama and the South, where it is grown for Christmas trees (*1*) and for ornamental planting. It is possible that trees may in the future become available for less specialized but more prosaic uses, such as fence posts. Judged by its growth habits in its native habitat (*2*), Arizona cypress is unlikely to become a source of lumber. Wood of the species is described as highly resistant to decay and insect attack (*3*).

Most of the Arizona cypress plantations in the South are too young to furnish timber of even fence post size. However, in 1949 sections of two trees almost 20 years old were obtained from a farm in Lee County, Alabama. The sections furnished enough material for four round and two split posts three feet long and at least three inches across at the small end. These, along with four round, untreated southern yellow pine posts, were set in a small test garden in a wooded area at Auburn. None of the posts contained visible heartwood. Depth of setting was one and one-half feet, and posts were located at random.

The posts were inspected at the end of 20, 34, 62, and 72 months. Inspection consisted of visual examination of the above-ground portion for insect holes and fruiting bodies, probing for soft spots with a screwdriver to about 6 inches below ground level, and exerting moderate hand pressure against the top. A post was deemed serviceable until it broke under hand pressure. An attempt was made roughly to compensate for the difference in leverage afforded by different post lengths by varying the pressure exerted. With this method of inspection, presence of termites could remain undiscovered in a post until it failed and the broken surface could be examined. Results of the inspections appear in Table 1.

TABLE 1.—SERVICE RECORDS OF UNTREATED ARIZONA CYPRESS AND SOUTHERN YELLOW PINE POSTS IN A TEST GARDEN

Post number	Type	Length	Top diameter	Inspection period, months after setting			
				20	34	62	72
		Feet	*Inches*		*Condition*[1]		
1	A. cypress, round	3	3½	S	X *R*	-----	-----
2	A. cypress, round	3	4	S	X *R*	-----	-----
3	A. cypress, round	3	4	S	S *R*	S *R*	X *R*
4	A. cypress, round	3	5	S	S *R*	S *R*	X *R*
5	A. cypress, split	3	5½x3	S	X *R*	-----	-----
6	A. cypress, split	3	6x3	S	S *R*	S *R*	X *R*
7	S.y. pine, round	7	4	S	X *R I*	-----	-----
8	S.y. pine, round	7	4	X *R I*	-----	-----	-----
9	S.y. pine, round	7	4½	S *I*	X **R** *I*	-----	-----
10	S.y. pine, round	7	4½	S *R*	X **R** *I*	-----	-----

[1]Code: S—serviceable; X—failed; R—damaged by rot; I—damaged by termites. Italic indicates damage within 6 inches of ground line. Bold face indicates damage both within 6 inches of ground line and above.

Average life of the Arizona cypress posts was 53 months, compared with 30 months for the pine posts.[1] A *t*-test of the difference between the two means (*4*) failed to indicate significance. However, there is only one chance in 12 that the difference is due to random variation. Attack by termites contributed to the failure of each of the pine posts; but none of the Arizona cypress was damaged by these or other insects. Failure of every post involved rot at the ground line vicinity. Rot was evident in the upper portions of half of the pine posts by the time they had failed. All of the Arizona cypress were sound above the immediate vicinity of the ground line.

Though this experiment was too small to yield conclusive results, it furnishes evidence that Arizona cypress sapwood from trees grown in Alabama probably has greater durability than southern yellow pine sapwood. It furnishes strong evidence that the cypress is more resistant to termites than the pine. Furthermore, the cypress seems to be markedly less subject to decay in portions above the ground line vicinity.

[1]This finding of an average life of 30 months for untreated sap pine posts in this area is in agreement with results of more extensive tests reported in minutes of annual meetings of the Coordinated Wood Preservation Council.

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Longleaf Pine Seedlings Damaged When Seed Trees Are Tractor-logged

In a removal cut of longleaf pine seed trees on the Escambia Experimental Forest in southern Alabama, tractor logging reduced the seedling stand by 7 percent.

Before logging was begun, 250 mechanically spaced milacre plots in a forty-acre compartment were examined and staked. Eighty-three percent of the plots had one or more pine seedlings. Nine seed trees per acre over 9.5 inches d.b.h. were removed and converted into sawlogs, poles, and pulpwood by commercial loggers. A D-4 tractor ground-skidded poles and logs into piles containing not more than one truck load. Loading was done with a mechanical loader. Pulpwood, which came mostly from pole and log tops, was cut into lengths at the felling point and loaded directly onto trucks by hand. Logging conditions were ideal—a firm, dry bottom on gently rolling terrain.

Two months after logging, while evidence of logging traffic was still plainly visible, the staked milacres were re-examined. Logging damage had reduced milacre stocking to 76 percent. Tested by chi-square, this reduction was significant at the 5-percent level. It also was noted that many of the best surviving seedlings had been skinned or otherwise damaged. Those that had emerged from the grass stage were the most vulnerable.

Results show that losses to longleaf seedling stands cannot be safely ignored when seed trees are removed by conventional tractor-logging methods. Special measures should be taken to minimize damage. Spot seeding, or planting after logging, may also be necessary.

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East Gulfcoast Research Center Southern Forest Experiment Station, Forest Service, U. S. Department of Agriculture

We Present

Harry Lee Baker

Few men in the forestry profession are as widely known as Harry Lee Baker. His influence on forestry progress can be traced from the national forests of the Northwest to the state and private forests of Florida, North Carolina, Virginia, and West Virginia. Many prominent foresters were employed and given field training by him, including State Foresters C. H. Coulter of Florida, Charles H. Flory of South Carolina, Alfred D. Folweiler of Texas, and James E. Mixon of Louisiana, as well as former State Foresters H. J. Malsberger and H. A. Smith, and J. E. McCaffrey, Earl Porter, Harold Sebring, James J. Goulden, Donald J. Weddell, and C. H. Schaeffer. All these and many more he refers to as "my boys."

Harry Lee is a native of Michigan where he was born February 24, 1888. He was graduated from Michigan State University (then Michigan Agricultural College) in 1912 with a B.S. degree in forestry.

During his college days, he was a varsity baseball player for four years and team captain one year. This extracurricular activity led to one of his first jobs. Harry Lee and three other men were employed as forest guards by Supervisor Dorr Skeels on the Kootenai National Forest in 1910. An incidental requirement was that they would help bolster the Libby, Montana, baseball team. Supervisor Skeels was often bantered for hiring baseball players as forest guards, but actually, according to Baker, there was little time for weekend baseball during 1910. This was the year of the terrible forest fires in which 64 men lost their lives in western Montana and northern Idaho.

Following graduation from college, Harry Lee served five years as district ranger on the Kootenai at Troy, Montana, later becoming administrative assistant to John F. Preston of the Branch of Silviculture. During this period he worked under District Forester Ferdinand A. Silcox who later became chief forester, and the late James W. Girard, well known in the profession for his contribution to timber estimating and valuation.

U. S. Forest Service photo

HARRY LEE BAKER and a group of "his boys" of the West Virginia Division of Forestry, photographed in 1952.

From 1918 until 1922 Harry Lee was supervisor of the Cabinet National Forest with headquarters at Thompson Falls, Montana at a starting salary of $1,800 a year. In 1921 at the old Trout Creek Ranger Station, he inaugurated a system for selecting and training fire control personnel later put into effect on many national forests. This is considered to have been the first intensive training course for lookouts, guards, and smoke chasers held in the Forest Service on a forest-wide basis.

Harry Lee left the Forest Service in March 1922, and for the next four years served variously as secretary of the Eastern Washington Timber Protective Association, district forester with the Virginia Forest Service, and assistant state forester in charge of fire control in North Carolina where one of the district foresters he supervised was Carl I. Peterson, present state forester of Tennessee. Returning to the Forest Service in 1925, he worked the next three years with J. G. Peters and Alfred Hastings in advancement of the program of the Clarke-McNary Act in the southern states.

One of his assignments was to assist the Florida Forestry Association to present the forestry problems of Florida to the public. His report *Forest Fires in Florida*, printed by the association, recommended creation of a state board of forestry, and was instrumental in getting the law passed which established the Florida Board of Forestry.

He became state forester of Florida in 1928. He says that 50,000 fires occurred in the woods each year, burning over 75 percent of the pine forests. A landowner with the courage to combat wildfires was truly "a missionary in a desert of firesetters," who were largely turpentine operators in the piney woods. In cooperation with the U. S. Forest Service and equipment companies Harry Lee and his assistants aided in the development of the first fire plows used to construct systems of fire breaks on the lands of cooperating owners. He conceived the idea of a water pump which could be operated from a fan belt on a truck engine. The Panama Pump Company utilized the idea in development of pumps now used widely in fire control work.

One project established many one-acre sample plots in plantations and other forest practices to show landowners the results of good management practices. Today, in Florida are many plantations which range from 20 to 25 years of age and which contain

25 to 35 cords of pulpwood per acre worth $150 to $200.

At the first meeting of the Florida Board of Forestry in 1928, Harry Lee supported the acquisition by the Forest Service of the Ocala National Forest. He later actively supported establishment of a naval stores laboratory by the U. S. Bureau of Chemistry and Soils, and the Southern Forest Experiment Station. Also, under his administration, the state forest nursery, the district forester's headquarters, and numerous state-private fire control projects were established in the same vicinity as the naval stores laboratory at Lake City. There are not many localities in the United States with so much federal, state, and private forestry activity going on in such a limited area.

Later, however, he encouraged the same Florida Board of Forestry to oppose the extension of the national forest system to include nearly 200,000 acres of land adjacent to the Ocala. As president of the Association of State Foresters he had been instrumental in getting the Fulmer Act passed in 1935. It provided for federal aid to the states in the purchase of lands for state forests. But no funds were ever appropriated for the purpose, and no state forests were established under the Act. It was his conviction that federal activities in forestry should be limited to those which the states and private interests could not reasonably carry out.

During Harry Lee's thirteen years as state forester, the Florida Forest Service grew from one expending $12,500 annually to one expending $195,000 of state funds alone. A system of state forests and parks was established to serve as training grounds and demonstrations, as well as recreation areas. He always insisted that state forests should operate within income, otherwise they could not be considered sound forestry demonstrations. The Blackwater River State Forest of 182,000 acres, one of the largest in the United States, has operated within income and is presently showing a profit, according to C. H. Coulter, state forester.

In 1929 he helped organize the Southeastern Section of the Society of American Foresters, serving as vice chairman in 1930 and chairman in 1931.

In 1940, Harry Lee left Florida to serve for two years as assistant director of forests in the Office of Land Utilization, Department of the Interior, in coordination of land utilization activities among the various bureaus of the Department. During 1943-1947 he was associate state forester of the Virginia Forest Service, in charge of public relations.

From 1947 until his "official" retirement in February 1953, he was assistant state forester in charge of forest management in West Virginia, and developed a forest management manual and a permanent, cumulative record of activities on county, district, and state levels.

Harry Lee is author of several publications on applied forestry. These include *Profitable Timber Growing* and *Possibilities of Pulp and Paper Making in Florida*. He collaborated with Ross Mellinger of the U. S. Soil Conservation Service in preparing *They Are Your Woods*, a farm woodlot management guide published by the West Virginia Conservation Commission.

Since 1953 Harry Lee has resided at 4605 Cardinal Boulevard, Jacksonville 10, Florida. He is active in the management of a large timber tract and intensive nursery and Christmas tree projects. One of the first to publicize the possibilities of tree growing in the South, he is now putting many of his ideas to work. Within a few miles of his home, he can see many results of his early efforts as state forester: valuable pine plantations now ready for utilization; concentrated state and private fire control activities; private tree nurseries; improved turpentine practices in the piney woods; and the numerous pulp mills with their supporting "tree farms."

Those of us who have worked with and for Harry Lee have learned from him many valuable lessons in administration and practical forestry. He has shown how persistence and patience applied to difficult problems bring results.

D. G. CUPPETT
I. V. ANDERSON

Points of View

Comments on "A Site Evaluation Concept"

It is good to see this paper and its valuable discussions of "total" and "current" site index. But Heiberg and White[1] have omitted some rather important recent work on site that is pertinent to their general discussion. We would like to fill this gap and add some northwestern observations in support of their contentions.

In their concluding paragraph Heiberg and White stated "Site is not one factor and site is not all factors. Site is the sum of all the *effective* factors among which usually one or more are dominant." This view is generally acceptable and is closely related to the "holistic" concept of site expressed by Hills (*8, 9*). Hills devised a classification that allows room for all site factors and requires determination of their effectiveness through research. Hills' ideas warrant serious consideration by both American and Canadian foresters. His emphasis on land form assists in preliminary groupings regardless of other factors and permits preliminary mapping of sites from aerial photographs. Emphasis of soil profile characteristics, pore pattern, regimes of moisture, and temperature factors leads to a frame of reference upon which vegetation influences may be superimposed and integrated. The possible other limiting factors related to mineral content of the parent soil material are noted. With the exception of their omission of the views of site held by Hills and his associates, we believe that Heiberg and White have presented a comprehensive picture of the situation.

We wish to add some comments with special reference to the Douglas-fir region. Although only Carmean (*2*) is cited by Heiberg and White, it is worth noting that earlier work by Hill, Arnst, and Bond (*7*) brought out most of the relationships shown by Carmean. In addition, the work of Gessel (*4*) and Gessel and Lloyd (*5*) indicated that, with high rainfall, factors other than moisture-holding capacity of the soil (as indicated by depth, texture and the effect of impeding layers) may effectively influence site. Lemmon (*11*) showed that total effective soil depth was the most important factor in determining quality of Douglas-fir sites in Oregon. Work by Forristall and Gessel (*3*) indicated that total soil nitrogen and total cation exchange capacity were much greater in the more productive soils. Poor soil drainage was the dominating influence in determining forest type, and depth to hardpan layer was an important criterion for productivity rating. We would emphasize and endorse the statement by Heiberg and White: "Allowances for topographic position and evaluation of properties of the subsoil that affect water movement, availability of water and nutrients, porosity, and aeration add to the reliability of a site index based on soil factors." In this connection, studies of ground vegetation and other factors by Spilsbury and Smith (*15*), Krajina and Spilsbury (*10*), and Becking (*1*) have provided valuable corroborative evidence.

It seems more than likely that water supply is not always the only or even the most important factor limiting the quality of site for Douglas-fir. Chlorotic foliage and poor growth have been observed in many localities where water is abundant. In several places and on a variety of soils, growth deficiencies have been remedied by application of nitrogen (*6*). The work of Tarrant (*16*) which has been cited frequently to indicate that nutrients are not ordinarily limiting to growth of Douglas-fir is subject to reappraisal. The superiority of foliar analysis over direct soil analysis has been demonstrated so conclusively that the whole question of nutrient-site relationships should be studied further in detail (*12, 19*).

Regarding the promise and definite limitations of lesser vegetation as a measure of site we agree generally with Heiberg and White. We should point out, however, that many foresters of the Douglas-fir and spruce—fir regions of British Columbia have found ground cover very helpful in extensive mapping and classification of site. The utility of ground cover types is likely to increase as foresters become familiar with the method and with the details of local conditions. Much study of the autecology or physiological requirements of key indicator plants is still required before we can be certain of the conditions actually limiting occurrence and growth of such plants.

We would like to emphasize another concept not stressed by Heiberg and White. We need to pay a good deal more attention to the combined influence of genetic factors in their reaction to the total climatic, edaphic, and biotic en-

[1]Heiberg, Svend O., and Donald P. White. A site evaluation concept. Jour. Forestry 54:7-10. 1956.

vironment in which trees are grown. In any particular location the genotype of the average dominant or codominant in terms of height growth is assumed to represent an unvarying standard for the species. Yet numerous provenance experiments have shown that great differences in rate and quality of growth exist among individuals grown in essentially identical habitats.

Variations in the rates and direction of forest succession are important. Fresh moraine does not represent the same site as it will in a few score years when its tree-growing potential has been raised by weathering and the accession of organic matter. On the other hand, logging and/or burning may be associated occasionally with retrogression of site quality. Secondary successions however induced require an evaluation of the probable degree of change in total productive capacity of the site for the genotypes concerned. Our understanding of tree physiology and forest soils is, at present, too inadequate to permit these evaluations.

Attention should be drawn to attempts made to bridge the gaps existing between the methods of determining site in older stands and the uncertainties of indirect methods. Wiley *(20)*, Schmidt *(14)*, Wakeley *(17)*, and Warrack and Fraser *(18)* have developed methods for assessing site quality of juvenile stands.

Limitations in use of harmonized curves, faulty corrections for age at breast height, uncertain classifications of crown class, and influence of density on height growth pose problems that lessen the utility of site classifications based on height and age. In addition, we have problem sites where one or more factors become suddenly limiting and cause great confusion in early estimates of site quality. Despite the shortcomings that have been pointed out, we must conclude with H. A. Meyer *(13)* that the height-age relationship remains the best single expression of site quality.

Apparently, we will never find one perfectly-integrated mathematically-precise index of site quality. We should continue to assess many factors and take the best features of all approaches in our attempts to develop ever more reliable measures of the productivity of forest land.

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Reviews

Prosperity Beyond Tomorrow

By Samuel H. Ordway, Jr. 208 pp. Ronald Press Company, New York. 1956. $3.

Prosperity Beyond Tomorrow brushes aside the anxieties and uncertainties obscuring mankind's future just as windshield wipers clear a dependable foresight when motoring. Objectives are identical; to assure a satisfactory interrelationship between visibility, speed of progress, and ability to stop. The book peers into the next century with credible predictions concerning wars, prosperity, resource use, ownership, populations, and the best employment of increasing leisure.

Who dares write such a book? Ordway endows his labors with the earthiness of citrus orchard and cattle ranch operation, the effectiveness in council of a skillful lawyer, and civic experiences earned while serving as New York City's Civil Service Commissioner and a U. S. Civil Service Commissioner. His conservation experiences include chairmanship of the Natural Resources Council of America, terms upon the Secretary of the Interior's Advisory Council upon Conservation, direction of the Interior Department's survey of Alaskan resource development, and the executive vice-presidency of the Conservation Foundation, which he helped establish. As a captain in the Naval Reserve, he dealt with and chronicled personnel and industrial relations problems.

His conservation writings have weathered public scrutiny with *A Conservation Handbook* (1949) and *Resources and the American Dream* (1955). His current book emerges from the circle of conservation thinkers centering upon the Conservation Foundation; including Fairfield Osborn, William Vogt, and Paul Sears, who wrote the foreword.

Ordway predicts there can be peace with Russia. He finds in "Soviet bureaucracy . . . inhumanity, cruelty, cold, calculating disregard for the individual . . . but not irresponsibility." He sees no opportunity for madmen like Hitler and Mussolini to break " . . . the mold of a discipline which would not destroy Russia and the world . . . For both Russia and the United States there is nothing to be gained economically, politically, or spiritually from all-out war . . . There will arise a colossal . . . will to substitute a rule of federated law for the present armament races and conflicts of sovereignty."

During this predicted peace, Ordway envisions several decades during which ". . . our planet will . . . keep on yielding to man, as we mine the earth, enough raw materials . . . to supply a sufficient level of living . . . we in the United States . . . shall have leisure time, in these decades of material prosperity ahead, to plan to avoid ultimate depletion of our resources and to assure . . . raw materials for the generations yet to come. . . . As machines increasingly reduce man-hours of work . . . a new sort of time for us is in the making . . . of substantial leisure through which it should be possible . . . to devise ways of stabilizing resource supply and demand and distribution, so that man may ultimately relax and absorb the spiritual as well as material satisfactions inherent in continuing prosperity."

Ordway avoids perils of Utopian phantasies in his chapters upon "Some Values and Dangers of Leisure" and "Population Pressures." He concurs with studies which doubt that the United States can ". . . feed, or absorb by migration, the surplus peoples now underfed in many areas abroad. . . . The only effective solution . . . lies in each country's or region's continuing to develop its own resources in the durable patterns of its own environmental capacity and facing up to its own population problem. . . ."

In common with others, Ordway trusts that the imminent production of a contraceptive tablet will curb population expansion in a manner meeting objections rising from cost, inconvenience, repugnance, and religious dicta.

As in previous books, Ordway advocates renunciation of gadgets and recommends wildland and wildlife recreation and solitude as valid substitutes. Necessarily he ends with "An ethic for the Age of Leisure which places hope for salvation in working with nature . . . As man, whatever his creed, does homage to a power greater than himself, a power than can destroy or save him, he respects nature."

J. V. K. Wagar
Colorado A & M College

American Universities and Colleges

Edited by Mary Irwin. 1210 pp. American Council on Education, Washington, D. C. 1956. $12.

The College Blue Book

Edited by Christian E. Burckel. 688 pp. The College Blue Book, Yonkers, N. Y. 1956. $10.

American Universities and Colleges, in its seventh edition, has been an increasingly useful reference work ever since its first edition in 1928.

In brief, it contains authentic descriptive data on the 969 accredited universities and colleges in the United States, Alaska, Hawaii, and Puerto Rico. In addition, it supplies information on some 2,000 approved professional schools in 23 fields. It does not include junior colleges in its listings.

Forestry is one of the 23 professional fields recognized by a brief chapter giving the history and development of forestry education together with a list of the 26

schools satisfying current professional standards.

A most informative section of the book is part one, "Education in the United States," mainly by Lloyd E. Blauch of the U. S. Office of Education. Literally a book within a book, this portion contains a wealth of explanatory material supported by excellent tables.

Another fascinating chapter has to do with the academic costume code. Present usage in gowns, hoods, caps, and the order of academic processions is explained. Incidentally, for readers who don't know it, the academic color associated with forestry is russet.

The American Council on Education is to be commended for the publication of this worthy book. It not only serves American educational institutions and the professions, but the counselors of students and the students themselves.

The College Blue Book, was first published in 1924. This is the eighth edition.

It is somewhat broader in coverage than *American Universities and Colleges* in that it lists every institution of higher education in the United States, regardless of accreditation or professional recognition. Junior colleges are included. In all, about 5,900 institutions are listed.

Understandably, in a work as comprehensive as this one, a complex system of codification is necessary. Although the system is consistent and can be followed after careful reference to abbreviations and sundry topics, it is not easy to use.

A brief section is devoted to forestry. It includes all the institutions offering forestry instruction, both professional and nonprofessional, and has a short statement on the Society of American Foresters.

A useful section includes maps of the states and Alaska with the locations of the institutions designated.

Supplemental information is given on associations, fraternities, and public education agencies. There are, in addition, numerous quotations and miscellaneous statements that detract from, rather than increase, the usableness of the book.

Both volumes, however, have great merit.

HENRY CLEPPER

Publications of Interest

A Summary of Current Forest Pest Problems for New York State: 1955-56 is a report compiled by the Committee on Insects and Diseases, New York Section, Society of American Foresters and published by the Extension Department of the State University of New York, Syracuse. Insect problems are listed, their extent indicated, and information is given on what agencies are primarily concerned. Research and cooperation needed receive attention and recent publications that may assist foresters in forest pest problems are listed.

* * *

Forestry Progress and Timbering Opportunities in the Republic of Liberia is an International Cooperation Administration publication written by Torkel Holsoe.

Liberia, the only independent Negro Republic of Africa, is one of the few countries in which I.C.A. is concerned that possesses appreciable forest resources. It still retains, despite shifting agriculture, a "body of almost untouched forest, extensive enough to constitute a resource adequate for the needs of the Nation's expanding economy."

This 66-page report (with extensive appendix) describes forest conditions as well as the work of I.C.A. foresters in aiding the Liberian government to initiate a forestry program. It should be of interest to foresters as well as to wood-using industries who might consider establishing operations in the hitherto unexplored tropical forests of Liberia.

* * *

Wilderness Day is a new 16 mm. color-sound motion picture about the Quetico-Superior Wilderness country of Minnesota and Ontario. It is produced by the Minnesota Foundation through a grant by the Louis W. and Maud Hill Family Foundation of St. Paul, Minn.

This film builds up an understanding and appreciation of the famous Wilderness canoe country along the international border and emphasizes the importance of keeping such areas green and beautiful. The film is not only entertaining but it is technically accurate and authentic and especially informative about wilderness canoeing and camping.

Film length 28½ minutes. Released for world-wide television. Directed and photographed by Roy Dale Sanders, Brainerd, Minn.

Wilderness Day is the first of a series of technically accurate conservation films to be produced through the grant of the Hill Foundation.

A ten man Motion Picture Advisory Committee was selected and set up especially to advise the Minnesota Foundation and the director of the films.

For information concerning sales, loan, and distribution of the film contact: Agricultural Extension Division, University of Minnesota, Farm Campus, St. Paul, Minn., or Minnesota Foundation, 305 Wilder Building, St. Paul 2, Minn.

* * *

The National Lumber Manufacturers Association has announced publication of a revised and illustrated edition of *Lumber From Forest To You*, a 32-page booklet explaining the importance of the lumber industry in the American economy.

The publication traces the growth of lumber manufacturing in the U. S. —from establishment of the first sawmills in the early 1600's to its present-day status as one of the nation's leading industries. Through text and pictures the reader is given a detailed account of sawmill operations and lumber distribution practices. Photographs show the various stages through which a log passes—from the time it is cut in the forest to its final phase of manufacture into lumber or other wood products. In explaining the makeup and mechanics of the lumber and wood products industries the publication gives information on the sources of raw material, products manufactured, problems involved, and progress attained. Special attention is given to the progress made in forest management and log utilization.

Single copies of the new illustrated edition are available from the National Lumber Manufacturers Association, 1319-18th St., N.W., Washington 6, D. C. at no charge. Additional copies are priced at 25 cents each.

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Society Affairs

Officers and Council
1956-1957

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Section Box Score
1956 Membership

Section	Applications received[1] June 1956	Total 1955	Total 1956
Allegheny	6	63	30
Appalachian	3	38	19
Central Rocky Mountain	2	12	21
Central States	2	44	19
Columbia River	7	100	48
Gulf States	1	107	37
Inland Empire	4	10	23
Intermountain	4	18	14
Kentucky-Tennessee	0	9	6
New England	6	50	47
New York	1	33	37
Northern California	1	33	43
Northern Rocky Mountain	0	44	24
Ozark	0	47	8
Puget Sound	0	65	31
Southeastern	3	85	31
Southern California	0	3	1
Southwestern	0	12	0
Upper-Mississippi Valley	3	51	41
Washington	0	2	1
Wisconsin-Michigan	7	40	61
Totals	50	866	542

[1]Student, Junior, Affiliate, Associate (Initial) grades only.

School Box Score
1956 Membership

School	Student applications received June 1956	Total 1955	Total 1956
Alabama Polytechnic Institute	0	18	6
University of California	1	17	34
Colorado A & M College	1	9	20
Duke University	0	3	4
University of Florida	0	17	3
University of Georgia	1	28	3
University of Idaho	2	4	16
Iowa State College	1	22	11
Louisiana Polytechnic Institute	0	13	12
Louisiana State University	0	43	12
University of Maine	0	12	11
University of Massachusetts	2	11	12
Michigan State University	1	14	26
University of Michigan	3	21	18
University of Minnesota	1	19	25
University of Missouri	0	26	1
Montana State University	0	25	17
State University of New York	1	23	35
North Carolina State College	1	22	3
Oregon State College	5	38	26
Pennsylvania State University	3	32	16
Purdue University	1	24	16
Utah State Agricultural College	0	12	7
University of Washington	0	28	13
West Virginia University	0	26	1
Yale University	2	16	12
Totals	26	523	360

The President's Column

DEWITT NELSON

In this issue of the JOURNAL there is an article by Mr. W. S. Rosecrans, entitled, "The Other Side of the Mountain." I urge you to read it. In the first part of the article he discusses some California problems, but I know they have their counterparts in other states and regions. With his usual discernment, Mr. Rosecrans has appraised achievements and failures.

In the last half of the article the author writes of the relationship between professional education and leadership in forestry fields. Here he places a challenge before the Society and our forestry schools. In recognition of its responsibility—the necessity for training men who are more than competent technicians—your Society is endeavoring, in cooperation with the Division on Education, to secure a foundation grant for the purpose of studying education in forestry and related fields.

J. W. Lehman, chairman of the Kentucky-Tennessee Section phrased this very well in his February News Letter:

"If the forester is to make the forest land contribute the maximum benefits to society, he must understand more than just growing and harvesting trees. He must develop a better understanding of economics, be able to sell ideas to a wide variety of people; write in an effective manner; work effectively with people of other interests and professions; and understand the relationship of the complex pattern of land management to the economy of the community."

There was a great teacher of moral philosophy and rhetoric at Williams College from 1830 until his death in 1887. James A. Garfield, a Williams graduate, who became President of the United States was once discussing the value of a true teacher. He said, "give me a log hut with only a simple bench, Mark Hopkins on one end and I on the other, and you may have all the buildings, apparatus, and libraries without him." This is the origin of the phrase, "Mark Hopkins on one end of a log and a student on the other."

Fortunately for foresters this relationship between student and teacher can be literal as well as figurative. The respectful and affectionate relationship which has existed through the years between foresters and their professors has been a most treasured aspect of our profession. This relationship needs to exist not only between college teacher and pupil but also between the seasoned woods boss and the neophyte scaler.

It is encouraging to note that many leaders in forestry are recognizing the need for broadening the base in forestry education. The schools cannot do it all, self-imposed learning and on-the-job training must also carry their share of the load.

* * *

Our hats off to the great Fire Prevention Conference held in New Orleans last April. That conference exemplifies what can be accomplished when everyone works together on a common problem—governors, district attorneys, sheriffs, justices of the peace, industry, state and federal organizations.

The South has its sights zeroed on the target and they are shooting both barrels. One barrel for those who learn through the conventional method of education and the other barrel for those who learn the "hard way"—the course that winds up in court.

Congratulations and good luck to the South in her all-out effort.

DeWitt Nelson

Fellows of the Society: Their Nomination and Election

The following statement is a digest of a report presented to the Council at its meeting on February 14 and 15, 1956. The report was prepared by Joseph S. Illick, and was submitted by him in behalf of a special Council committee appointed by past President E. L. Demmon. The other members of the committee are W. J. Brown and S. G. Fontanna.

The action taken by the Council on the committee's recommendations was contained in the report of the Council meeting and published in the April issue of the JOURNAL, *pages 279 and 280.*

The grade of Fellow was established in the Society of American Foresters in 1917. The first Fellows, 6 in number, were elected in 1918. They were, Bernhard E. Fernow, Henry S. Graves, William B. Greeley, Gifford Pinchot, Filibert Roth, and Raphael Zon.

From this initial election in 1918 to December 31, 1955, a total of 110 Fellows has been elected. Of the 110 Fellows, 34 are deceased. This leaves 76 living Fellows as of December 31, 1955.

The election of Fellows has been a rather unsettled problem ever since this grade was established. During the 1930's it became necessary to make a study of the situation. As a result, a number of significant improvements were made, relating chiefly to nomination and election procedures.

Now it seems appropriate to review again the situation for the purpose of ascertaining what recommendations should be made for possible improvements. This new look seems especially appropriate because of the Society's unusual rapid growth in recent years, now with a total membership in excess of 10,000.

In May 1955, President E. L. Demmon communicated with a group of Council members (W. J. Brown, S. G. Fontanna, and J. S. Illick, chairman) inquiring if they would be willing to study and report on the present situation regarding Fellows. The assignment was accepted, and a progress report was submitted to the Council at its mid-summer meeting at Missoula, Montana. The Council then directed that the study be continued, and that the committee submit a full and, if possible, a final report with recommendations at its next meeting at Portland, Oregon in October. A semi-final progress report was presented at Portland, but because of discussion-time limitations, it was decided to consider again this important subject at the New Orleans meeting in February, 1956.

From the studies that have been made thus far, it appears that improvements can be made along at least three major lines, namely:

1. An amplification and clarification of the general constitutional and bylaw provisions relating to Fellows.
2. Improvements in nominating procedures and practices for Fellows.
3. Improvements in election procedures and practices for Fellows.

Amplification and Clarification

The present Constitution of the Society (Article III, Section 6) includes

the following provisions relating to Fellows:

"Fellows shall be foresters of outstanding achievements as leaders in responsible directive positions or distinctive individual work of a fruitful character. They shall be engaged in forestry work at the time of their election."

This provision has been in effect without modification since 1917, when the grade of Fellow was first established.

It is recommended that Article 111, Section 6, be amplified and clarified.

Nominating Procedures

The nomination procedures for Fellows have been frequently, and at times, rather drastically, revised. As a result, the nominating process has been greatly improved and on the whole is now operating quite satisfactorily.

The present constitutional provision (Article IV, Section 3) relating to Fellows is: Nomination to the grade of Fellow shall be made by the written endorsement of twenty-five Members and Fellows."

Bylaw 9 provides that: "A petition nominating a Member for advancement to Fellow must be accompanied by a biographical sketch of the candidate, including a brief account of his professional career and accomplishments. A sketch of biographical facts not exceeding 200 words shall be printed for each nominee for the grade of Fellow."

Because an adequate number of nominees have been forthcoming regularly, no drastic changes in the Constitution or Bylaws are recommended. There are, however, two subjects relating to the nomination of Fellows deserving of further consideration. They are:

1. A fuller and more standard presentation of a nominee's qualifications.
2. A wider and more equitable distribution of age-classes among nominees.

In regard to the first suggestion, there is a rather widespread feeling throughout the Society that fuller and more comparable information about the nominee's contributions, achievements, and services should be prepared. Other professional organizations have developed a special printed form for the providing of this essential information.

A recently elected Fellow suggested that it would be helpful to present such information under the following headings:

1. Accomplishments in forestry.
2. Contributions to the profession.
3. Services to the Society.

The second suggestion, namely, that of achieving a wider and more equitable distribution of age-classes among the nominees, has become of such importance that it deserves rather full consideration. However, the nomination and election processes are so interlocking in nature and operation, that this important topic will be considered later in this report, when special consideration will be given to possible improvements in election methods.

Election Procedures

The principal weakness in the election of Fellows is not in *getting them nominated*, but in *getting them elected*. Table 1 shows the wide divergence between the number of Fellows nominated and the number elected from 1918 to 1955.

TABLE 1.—NUMBER OF FELLOWS NOMINATED AND ELECTED (1918-1955)

Period	Number of Fellows nominated	Number of Fellows elected	Percent elected
1918-1920	12	6	50.0
1920-1929	18	5	27.7
1930-1939	40	15	37.5
1940-1949	140	55	39.3
1950-1955	110	29	26.4
Total	320	110	34.4

Out of a total nomination of 320 candidates for Fellow, 110 were elected. This represents a general average of one Fellow elected out of approximately three nominations.

Somewhat less than one-half of the persons that were not elected were not re-nominated again. But even more significant is the fact that 44 of the 110 Fellows elected succeeded in being elected after more than one nomination, five after their fourth nomination, and one after his sixth nomination. Also of interest is the fact that a substantial number of candidates did not win election to Fellow even after several nominations, and one candidate failed of election after four nominations and another after five nominations.

In attempting to appraise the present Fellow situation, it should be helpful to give consideration to the following factors and findings:

1. During the 36-year period (1918-1953) 34.4 percent of those nominated have been elected.

2. In specific years the ratio of nomination to election has ranged all the way from 0 to 100 percent. For example, during the 1920's and early 1930's, it was not unusual to have all those nominated for Fellow elected. In stront contrast were the elections of 1935, 1937, and 1941. In 1935 only 1 out of 11 candidates was elected, in 1938 only 1 out of 13 nominees was successful, and in 1941 there were 27 nominees for Fellow and not a single one was declared elected as a result of the election procedure then in effect.

3. The largest number of Fellows nominated in any one year was 39, in both 1948 and 1953.

4. The largest number of Fellows elected in any one year was 11, in 1947, 1949, and 1951.

5. The ratio of nomination to election has not been improving in recent years, for the lowest ratio (26.4 percent) occurred during the six-year period from 1950 to 1955.

It is clearly obvious that the present election situation is not a healthy one for the Society. In seeking for effective remedial measures, it seems appropriate first to ascertain reasons for the present unsatisfactory conditions. This objective may be achieved by asking several questions.

James W. Cruikshank (1908-1956)

James Walker Cruikshank, 47, chief of the Division of Forest Economics Research, Southeastern Forest Experiment Station, Asheville, N.. .C.. died May 9 after a brief illness.

Born in Deerfield, N. Y. November 14, 1908, he was a forestry graduate of Cornell University in 1930. He immediately entered the U. S. Forest Service, and was assigned to forest economics research at the Southern Forest Experiment Station, at New Orleans.

In 1943 he was transferred to the Southeastern Station at Asheville and was promoted to head up the Station's economic research activities.

Mr. Cruikshank was the author of numerous articles and papers on the forest resources, timber supply, and forest industries of the South. He had been a Member of the Society of American Foresters for more than twenty years, and was formerly vice chairman of the Appalachian Section.

1. *Has the number of nominees for Fellow been excessive?*

Occasionally one may hear the claim that the number of nominees for Fellows has been excessive. However, in reviewing the situation on the whole, and in comparison with honorary membership practices in other organizations, one cannot do otherwise than come to the conclusion that the nominations have not been excessive. In a professional society with a membership of more than 10,000 and only 76 living Fellows, the biennial nomination of 20 to 30 or even 40 Members to the grade of Fellow definitely remains in the realm of what is generally regarded as fair and reasonable.

2. *Have the nominees been well qualified?*

Occasionally it is claimed that the wide divergence between the number of nominees for Fellow and the number elected is due to a lack of adequate qualifications on the part of some nominees. A review of nominees' service and achievement records, including a detailed consideration of representative cases, reveals that in relatively few cases has this been a valid reason for this wide divergence. Admittedly, when personal judgment plays so important a role, as it definitely does in the appraising of qualifications for Fellow, one must expect some diversity of opinion. However, by giving full consideration to this and other closely related factors, one still cannot do otherwise than come to the conclusion that the nominees for Fellow on the whole have been rather well qualified. It follows, therefore, that one must look elsewhere for the real reasons for this wide divergence.

3. *Have the electors had an adequate and clear understanding of the approximate number of Fellows that can very properly be elected?*

There is growing evidence that a considerable number of the electors have not had an adequate and clear understanding of the number of Fellows that could very properly be elected. The Society records show that not infrequently electors have voted for as few as three, five, or six nominees out of a total slate of twenty, thirty, or forty. It is clearly obvious that if a substantial number of electors vote on so conservative a basis, it can have a very decisive effect in any election.

This conservative voting may stem from attitudes expressed during the early development periods of the Society. For example, in 1919 the Executive Council expressed the belief that "a comparatively small number of men should be chosen as Fellows, so as to make election to this grade a distinct honor." In the Constitution of 1935 appears the provision that "candidates for Fellow shall be selected from among the oldest and most widely known Senior Members." In a special committee report of the Society submitted in 1935 appeared the recommendation that "Election to Fellow is the highest honor in the power of the Society to bestow. It should go to the older members who are otherwise qualified. Every nominee for Fellow shall have had at least twenty-five years' service in forestry."

4. *Have the electors been personally acquainted with or adequately informed regarding the nominee?*

A considerable number (in some cases a majority) of electors were not personally acquainted with the nominees for Fellows, nor were they otherwise adequately informed regarding their qualifications and achievements. Among the reasons for this unfortunate situation are:

The rapid growth of the Society, especially in recent years. Total membership now in excess of 10,000.

The wide geographical distribution of Society membership.

The limited printed information made available about nominees. (Approximately 200 words.)

The advanced age of Fellows serving as electors. Of the 76 living Fellows, 13 are in excess of 75 years. Of this number, 9 are over 80 years, the oldest being 87 years.

The inactive professional status of some Fellows. Most of the 76 living Fellows are now in full or partial retirement. Less than 20 of them now have full-time responsibilities in forestry work.

The detached location and status of retired Fellows. Many of the Fellows now in retirement have detached themselves largely or wholly from forestry activities, including Society affairs.

Election of 1955

In the election of 1955 there were 37 nominees for Fellow, of whom 9 were elected. The following information should be helpful in understanding some of the election procedures, and the results of this election:

Total number of eligible electors	78
Total number of Fellows	69
Total number of Council members (not Fellows)	9
Total number of electors who voted	66
Number of votes necessary for election	33

The largest number of votes cast for any of the candidates for Fellow in the election was 51. The other eight successful candidates received the following number of votes: 46, 42, 41, 41 39, 36, 35, and 34.

There were 8 nominees that received within 5 votes of the required number for election. There were also 6 nominees who received less than 10 votes. Two candidates received only 5 votes each, 2 received 6 votes each, and 2 received 9 votes each.

Of considerable interest is the number of the 37 nominees for whom the individual electors cast favorable ballots. It ranged from a high of 37 to a low of 3. One elector cast a favorable vote for each of the 37 nominees. Next in rank was an elector who cast a favorable vote for 32 of the 37 nominees. Ten of the 66 electors voted favorably for 20 or more of the 37 nominees. At the lower end of the voting scale, 10 of the electors voted favorably on 8 or less of the 37 nominees. One elector voted favorably for only 4 of the 37 nominees, and another cast a favorable vote for only 3 nominees.

Need to Improve Situation

A real need exists to improve the Fellow situation. In appraising this statement it should be clearly understood that no justification has been found for the occasional claim that the present Fellows "have banded themselves together as a sort of a fraternity inside the society" or that they aid to create and maintain "a self-perpetuating body." These assertions are definitely not founded on fact. While it is true that some of the present Fellows belong predominantly to older age-classes, and may have become rather inactive and quiescent in forestry activities and Society affairs, they are a highly respected and dedicated group, who continue to bring honor and prestige to our Society.

Phillip W. Ayres (New Hampshire) had the distinction of being the oldest forester (78 years) ever elected a Fellow. He died in 1946, six years following his election. Next oldest at the time of election—77 years—are John A. Ferguson (Pennsylvania) and Ellwood Wilson (Canada). The latter lived less than three years following his election. E. A. Sterling, elected a Fellow in 1953 at the age of 75, lived less than a year following his election.

Only 8 of the 110 foresters who have been elected Fellows were under 50 years at the time of their election. The late William B. Greeley had the distinction of having been elected a Fellow at the youngest age—39 years. Raphael Zon ranks second, having been elected at the age of 44.

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TABLE 2.—NUMBER OF FELLOWS BY AGE GROUPS (WHEN ELECTED)

Age group (years)	Number of Fellows
75 and over	7
70-74	8
60-69	61 (56 percent)
50-59	26 (24 percent)
40-49	7
Below 40	1
Total	110

Only two of the 8 Fellows elected prior to the age of 50—Henry Clepper and Henry Schmitz—were elected during the past 25 years. The other six were elected prior to 1930. Even more significant is the fact that since 1942 only 4 members of the Society under the age of 55 years—Henry Clepper, Frank Kaufert, Richard McArdle, and Hardy Shirley—have been elected Fellows.

Time is marching on, and if progress is to continue it is important that consideration be given to improvements in Society policies and practices. An ample body of well qualified foresters is now available for nomination for the grade of Fellow. A substantial number of these potential Fellows are in the age brackets of 40 to 50, and 50 to 60 years. It is entirely proper, and in many respects advantageous, to open the way to a more generous representation of these younger age classes among the Fellows, for there exists a rather widespread feeling that the nominations for Fellow have been coming too late in life, even after retirement from active professional duties and services.

Readers are again reminded that the foregoing statement is a summarization of a much longer study. The action taken by the Council on the recommendations are well reported in the April issue of the JOURNAL, *pages 279-280.*

Robert E. Dils Appointed to Editorial Board

President DeWitt Nelson has appointed Dr. Robert E. Dils as associate editor for *Watershed Management* on the editorial board of the JOURNAL replacing Dr. Edward A. Colman, who was appointed to that position shortly before his death on March 20.

Dr. Dils, associate professor of forestry at the School of Natural Resources, University of Michigan, received his BS and MF degrees in forestry from Colorado A & M College in 1946 and 1947, respectively. He received his PhD in soil science from Michigan State College in 1952.

Prior to going to the University of Michigan, Dr. Dils was instructor, assistant professor, and associate professor of forestry, respectively, at Michigan State University.

Dr. Dils is the author of numerous scientific articles and bulletins.

He has served as secretary, vice chairman, and is the current chairman of the Division of Watershed Management of the S.A.F.

Exchange of Letters Between S.A.F. and S.C.S.

Editors note. — The following exchange of letters between S.A.F. President DeWitt Nelson and Mr. D. A. Williams, administrator, Soil Conservation Service, U. S. Department of Agriculture arose from resolutions adopted by the Allegheny and Appalachian Sections of The S.A.F. and submitted to the Council at their February, 1956 meeting. The two resolutions were published in full on pages 281-282 of the April issue of the JOURNAL, together with a report of the Council's action on same.

March 2, 1956
315 State Office Bldg. 1
Sacramento 14, Calif.

Mr. D. A. Williams, Administrator
Soil Conservation Service
U. S. Department of Agriculture
Washington 25, D. C.

Dear Mr. Williams:

This will acknowledge your letter of February 17 with respect to resolutions adopted by the Allegheny and Appalachian Sections of this Society. For your information, I enclose verbatim copies of the resolutions.

These resolutions were carefully considered at a meeting of the Council of the Society held February 19-21. In addition, supplementary letters from several sources within the forestry profession were also considered and discussed.

Let me assure you that the Council is greatly pleased to know you are "most interested in furthering forestry work in this country" and that the administrative officials of the Service "are concerned about the technical adequacy of our work with soil conservation districts." We, on the Council, have never doubted either statement, and we sincerely commend the Service for its valuable work in disseminating information about forestry to farm woodland owners.

We have been informed that it is the policy of the Soil Conservation Service that those farm planners who lack professional forestry education shall consult with professional foresters, especially those in state and other public agencies, on technical forestry matters and particularly when silvicultural services are to be performed.

The criticisms brought to the attention of the Council were not directed at that policy. Rather the trouble seems to have originated in those in-

PROCEEDINGS
(1955)
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stances when non-professional farm planners departed from the policy by making recommendations as to silvicultural practices.

Moreover, such instances have been sufficiently significant to warrant two of our Sections, together with certain individual members, bringing them to the attention of our Council.

Accordingly, the Council on February 21 unanimously directed me to send you copies of the two Section resolutions, and to express the strong position of the Society against non-professional workers in public agencies carrying on technical forestry practices.

In transmitting this statement, I want to emphasize that the Council's action is not to be construed as questioning the competence of the professional foresters in the Service. Quite the contrary; our members gladly acknowledge the technical ability of the S.C.S. foresters and wish that there were more of them.

Under federal law, the State Forester is the recognized and responsible agent for providing the advisory service to small timber land owners. We realize that in some states they have been unable to meet this responsibility in its entirety, and in some areas the Soil Conservation Service has continued to provide competent forestry advice through professional foresters. I am sure this spirit of cooperation is appreciated.

Perhaps there is need for rewriting and properly interpreting Title 9 of the Administrative Regulations, Department of Agriculture, in order to obtain a clear-cut division of work responsibilities.

I regret that distance makes it impractical for me to discuss this matter with you personally, though on my next visit to Washington I shall try to call on you. Should you be in Sacramento any time in the near future, let us try to get together here.

Mr. Henry Clepper, our Executive Secretary, is located in Washington, D. C. and will be glad, I am sure, to call at your office at your convenience. Meanwhile, any statements you care to make in clarification of the Service's position will be made available to our Council and to the two Sections concerned.

Yours Sincerely,
DEWITT NELSON
President (S.A.F.)

Washington 25, D. C.
March 28, 1956

DeWitt Nelson, President
Society of American Foresters
315 State Office Bldg. 1
Sacramento 14, Calif.

Dear Mr. Nelson:

I appreciate your good letter of March 2, 1956, with which you transmitted copies of resolutions adopted by the Appalachian and Allegheny Sections of the Society of American Foresters, and in which you reported the National Council's action on those resolutions. While I do not have any plans to be in California soon, I am glad to accept your invitation to visit with you in Sacramento for a discussion of this subject when I do get out that way, and would appreciate it if you could schedule a little time with me on your next trip to Washington.

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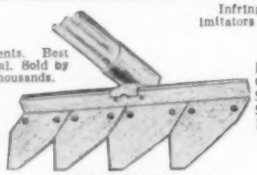

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owners and operators who are cooperating with soil conservation districts, so they may conserve their soil and water resources through improved use of the land devoted to wood crops. We think that landowners and operators should be encouraged to give the same careful attention to the land they use for producing wood as they give to the land they use for the production of other crops. I am sure that you and the other members of the Council would not wish us to exclude the woodland in our work with land owners and operators, and that you want the woodland to get its appropriate share of consideration in the nation's agricultural programs.

As of January 1, 1956, the Soil Conservation Service was working with 2677 soil conservation districts in all States and Territories. Within these districts are included over 90 per cent of all the small private woodland (296,000,000 acres) held by some 4,500,000 owners. As of that date, we have worked with more than a third of the land owners and operators in soil conservation districts, most of whom own some woodland.

The Soil Conservation Service is aware of the magnitude of the conservation job that farmers and ranchers have ahead of them. They are coming to recognize the importance of the job too and they welcome assistance in doing it. In doing this job we certainly will encourage soil conservation districts to get help from all sources, and we have encouraged the execution of memoranda of understanding between soil conservation districts and the State Forestry Departments, believing there is much to be gained by bringing together local leadership and professional help. We have encouraged and assisted soil conservation districts to make advance estimates of their tree planting stock needs and submit them to State Foresters and private nurseries so that suitable production goals might be established. We have encouraged soil conservation districts to aid in sponsoring county participation in cooperative fire protection and cooperative forest management programs. There is of course much to be done in each of the above fields of activity, especially cooperative fire protection, since I understand that nearly 20 per cent of private woodland is still outside of organized forest fire protection districts.

It continues to be the policy of the Soil Conservation Service for our personnel to consult with other professional people who are engaged in related technical fields. Certainly forestry is no exception. We appreciate your expressed wish that we might have additional forestry personnel. I assure you it is our desire to have an adequate balanced staff, and I am pleased to have your Council express confidence in the technical ability of our foresters. We are very proud of the contributions they have made and are continuing to make in helping farmers recognize and utilize the woodland potential of their land and in the advancement of private forestry.

There is no disagreement between the Soil Conservation Service and the Society of American Foresters on the point that non-professional personnel should not develop recommendations as to silvicultural practices. Even though our farm planners are professional soil conservationists, we do not expect them to assume responsibility for such recommendations. We do expect them, after being trained by our own and other foresters, to use technical specifications developed by foresters to assist land owners and operators in their choice of practices and in learning how to use those practices in their woods. Such technical specifications should be in harmony with those of the U. S. Forest Service and the State forestry agencies. We require our farm planners to recognize when a farmer or rancher should be encouraged to seek professional assistance which we do not have available or which it is not appropriate for us to provide. This applies especially to forestry because of the responsibilities of the State forestry agencies, although it applies also to other specialized technical fields in which we are involved.

It is very difficult to avoid occasional infractions of the policies of a large organization, but I am inquiring into the details of the specific case cited at the Appalachian Section meeting. If we find that the facts are at variance with the previous report we will furnish you further information on that case. Incidentally, you doubtless have a copy of the minutes of the January 28, 1956 meeting of the Appalachian Section as a part of the Council's record on this resolution. I am sure they would be of interest to you.

I want to take this opportunity to assure you that the Soil Conservation Service is *not* a *forestry* agency. Nor does it desire to be! It is our desire to aggressively further the program of soil and water conservation that the

Congress has directed and the people of America want. We hope to see that accomplished with the full cooperation of concerned agencies, public and private. We solicit the help and counsel of all. Also, we welcome the continued interest and suggestions of the Council of the Society of American Foresters in our soil and water conservation work, including our activities toward furthering the woodland owner's work in his woods.

Sincerely yours,
D. A. WILLIAMS,
Administrator

Resolution

WHEREAS: The Congress of the United States has enacted Public Law 587 which provides for the termination of federal control and supervision over the trust and restricted properties of the Klamath, Modoc, and Yahooskin Band of Snake Indians,

AND WHEREAS: Tribal property for the most part consists of a sustained yield forest capable of contributing substantially to the stability and welfare of the communities near which and the region in which it is located,

AND WHEREAS: Members attending the 1956 Annual Meeting of the Columbia River Section of the Society of American Foresters are of the opinion that Public Law 587, dealing with the Klamath Indian Reservation, is so worded as to jeopardize orderly distribution and continued sustained yield management as well as other factors of multiple use of the forest property despite the intent of Congress as expressed in Report #2483 of the House Committee on Interior and Insular Affairs.

BE IT THEREFORE RESOLVED: That the members attending the 1956 Annual Meeting of the Columbia River Section of the Society of American Foresters recommend to the Congress of the United States and the Department of the Interior that Section 5 of Public Law 587 should be amended during the present session of Congress to assure continued sustained yield management of the Klamath Forest Property, and that future legislation dealing with termination of Federal Supervision over Indian Affairs at other substantially timbered reservations should recognize the concept of sustained yield forest management as being vital to the welfare of the nation, and should make definite provisions for sustained yield management.

AND BE IT FURTHER RESOLVED: That copies of this resolution be forwarded to the President, Members of the Council and all Section Chairmen of the Society of American Foresters.

Columbia River Section Holds Meeting

The 1956 annual meeting of the Section was held in Longview, Washington, on April 13th and 14th, with the Longview Chapter as host. The theme of the meeting was "Forest Insects and Disease."

On the 13th approximately 115 foresters toured two local mills and a nearby tree farm which provides timber for one of the mills. The morning was spent in viewing the prefabrication plant, end- and edge-glue plant and sawmill of Weyerhaeuser Timber Company and the Flakewood plant, kitchen cabinet factory and pole treating plant of The Long-Bell Lumber Company.

In the afternoon the group made a field trip into the St. Helens Tree Farm maintained by Weyerhaeuser Timber Company. In this area northeast of Longview, the foresters observed stand improvement operations (thinning and salvage), reloading, prelogging and main logging operations.

The Section officers meeting was conducted in the evening.

Dan D. Robinson, Section chairman, presided over the sessions on the 14th at the Hotel Monticello. Approximately 160 heard the following talks: "Place of Partial Cutting in Management of Douglas-fir" by Leo A. Isaac, Pacific Northwest Forest and Range Experiment Station, Portland, Ore.; "An Evaluation of Insect and Disease Research Needs in Oregon and Washington—Part II, Diseases" by Dr. L. F. Roth, Oregon State College, Corvallis, Ore.; "Part I, Insects" (part one of above subject) by Valentine M. Caroline, Pacific Northwest Forest and Range Experiment Station, Portland, Ore.; and "Disease Causes Hemlock Mortality" by Donald H. Baisinger, Crown Zellerbach Corporation, Port-

(Continued on page 420)

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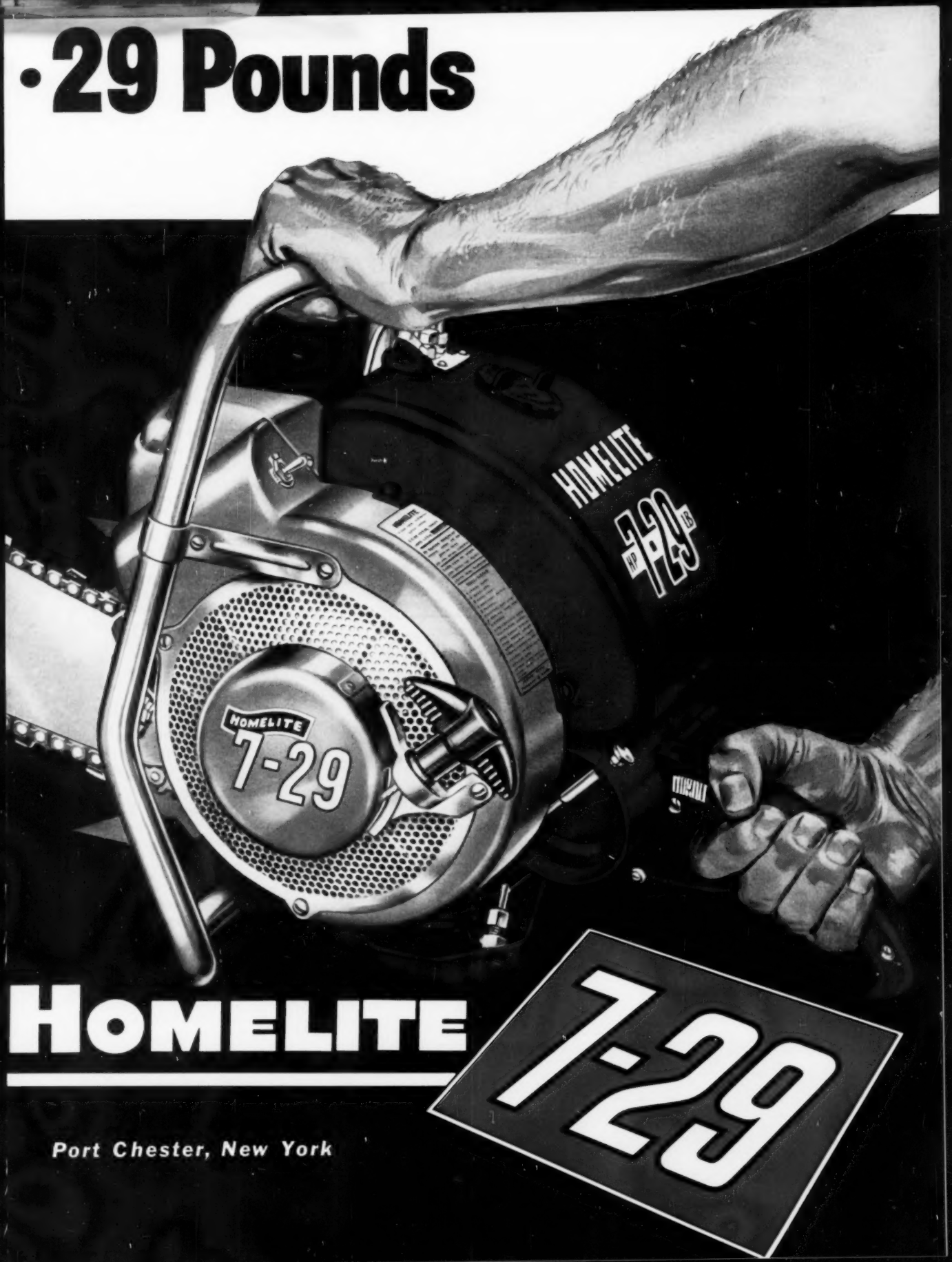

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The Section business meeting also was held during the day.

The meeting was concluded with a buffet banquet in the evening at the Hotel Monticello. Over 100 foresters and guests were in attendance to hear an address by Dr. Winton I. Patnode, director of research for Weyerhaeuser Timber Company. D. Nelson Jeffers of Weyerhaeuser acted as toastmaster for the evening.

Northern California Section Elects Officers

Leon R. Thomas, supervisor of the Sierra National Forest with headquarters at Fresno, Calif., has been elected chairman of the Northern California Section, Society of American Foresters for the ensuing year, it has been announced by retiring chairman Ken Macdonald of Woodleaf.

Other new officers of the Section are: vice chairman, Myron Wall, consulting forester of Sacramento; treasurer, Earl Sechrist, forester for the California Division of Forestry in Sacramento; and secretary, William T. Jacobson, California Division of Forestry in Fresno.

Sections Report on Publication of "Western Forester"

Western Forester, a monthly joint publication of the Puget Sound and Columbia River Sections, S.A.F., reports at the end of its seventh month a distribution to some 1,600 S.A.F. members in Oregon, Washington, British Columbia, Alaska, and Hawaii.

Members feel *Western Forester* is providing an excellent tie, both social and activity wise, between the members over this extensive area. It carries the minutes of the Chapter and Section meetings, resolutions, announcements, forestry articles and ideas, and paid ads.

As present secretary-treasurer of the Puget Sound Section, D. L. Fraser, 406 Transportation Bldg., Olympia, Wash. is editor. Lloyd Thorpe assisted by editing the first issue and he still helps, along with many others. The Chapter secretaries have cooperated nearly 100 percent by sending minutes in each month. Editing is limited primarily to cutting the material to fit the space.

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The average net cost for printing and mailing for the first six issues has been $82. The first four issues contained four pages and the last two have been six pages. The advertising rates have been $20 for a quarter page ad; $12 for ⅛ page; and $2 per column inch for anything smaller. Advertising is solicited on the basis of avoiding competition with JOURNAL advertising. *Western Forester* is still new but has already received widespread approval by the Sections' members.

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatements received in the Society office during the month of April are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of July 1, 1956. Communications from voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

Byrne, J. G. Wright, A. E.
Whitfield, C. L.

Junior Grade

Ruziska, W. E., County Forester, W. Va. Cons. Comm., Lesage, W. Va.; W. Va. Univ., B.S.F., 1950.

Trexler, F. L., Forester, Pa. Dept. of Forests & Waters, Harrisburg, Pa.; Pa. State, B.S.F., 1950.

Wiggins, G. R., 518 Bonsall Ave., Yeadon, Pa.; Pa. State, B.S.F., 1954.

Appalachian Section

Student Grade

NORTH CAROLINA STATE COLLEGE

Zoochi, J. L.

Junior Grade

Senter, E. E., Forester, W. Va. Pulp & Paper Co., Covington, Va.; State Univ. of N. Y., B.S.F., 1951.

Sharp, N. C., Exec. Asst. City Mgr., City of Fredericksburg, Va.; N. C. State, B.S.F., 1950.

Central Rocky Mountain Section

Student Grade

COLORADO A & M COLLEGE

Brown, E. V.

Member Grade

Patton, J. C., 2105 Crawford, Bellevue, Nebraska. (Junior, 1948).

Affiliate Grade

Parsons, W. A., Grad. Student, Colo. A & M, Fort Collins, Colo.; Colo. A & M, B.S., (Forest Recreation), 1954.

Central States Section

Student Grade

PURDUE UNIVERSITY

Spangler, J. H.

Junior Grade

Campbell, O. F., 1533 Amy Ave., Whiting, Ind.; Iowa State, B.S.F., 1953.

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Johnson, D. K. Sager, W. H.
Maher, D. G. Zechentmayer, R. D.
Morris, R. M.

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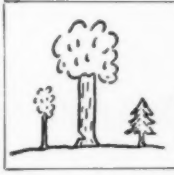
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Klamath Falls, Oregon

Junior Grade

Bode, A. T., Owner & Mgr., Bode Inspection Service, Oswego, Ore.; Univ. of Wash., B.S.F., 1927.

Member Grade

Jewett, H. P., 1069 N. 20th, Springfield, Ore. (Junior, 1949).

Piha, L., 326 N. 15th, Corvallis, Ore. (Junior, 1949).

Reynolds, C. E., Consulting Forester, Beaverton, Ore. (Junior, 33R53).

Smith, H. B., P. O. Box 496, Pilot Rock, Ore. (Junior, 1949).

Vincent, R. M., P. O. Box 2, Shady Cove, Ore. (Junior, 1949).

Affiliate Grade

Waldron, C. B., Dist. Ranger, U.S.F.S., Lakeview, Ore.

Gulf States Section

Junior Grade

Walters, H. L., P. O. Box 33, Natchitoches, La. Reinstatement.

Member Grade

Shetter, W. L., 404 Court St., Hattiesburg, Mississippi. Reinstatement.

Affiliate Grade

Ecke, H. R., Asst. Chief, U. S. Border Patrol, El Paso, Texas.

Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO

Blake, G. M. Krinard, R. M.

Junior Grade

White, H. Z., Production Mgr., St. Maries Lbr. Co., St. Maries, Idaho; Univ. of Idaho, B.S.F., 1926.

Member Grade

Duvendack, G. H., Forest Supv., U.S.F.S., St. Maries, Idaho. (Junior, 1955).

Harris, G. A., Assoc. Prof., Wash. State College, Pullman, Wash. Reinstatement.

Affiliate Grade

Kegel, E. E., Farm Forester, State Div. of Forestry, Colville, Wash.; Wash. State, B.S., (Forestry), 1941.

Intermountain Section

Junior Grade

Colton, L. J., Forester, U.S.F.S., Evanston, Wyo.; Utah State Agric., B.S.F., 1941.

Combs, J. C., Research Forester, U.S.F.S., Ogden, Utah; State Univ. of N. Y., B.S.F., 1955.

Hyatt, M. T., Dist. Forest Ranger, U.S.F.S., Freedom, Wyo.; Colo. A & M, B.S.F., 1943.

Smith, M. F., Salesman, Reilly Atkinson & Co., Boise, Idaho; Univ. of Idaho, B.S.F., 1953.

Kentucky-Tennessee Section

Junior Grade

Campbell, S. W., Dist. Ranger, U.S.F.S., London, Ky. Reinstatement.

Edwards, S., Box 332, Lexington, Tenn. Reinstatement.

Member Grade

Anderson, H. O., Dist. Forester, Tenn. Div. of Forestry, Dickson, Tenn. Reinstatement.

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New England Section

Student Grade

UNIVERSITY OF MASSACHUSETTS

Blomstrom, G. H. Hinkley, R. D.

YALE UNIVERSITY

Johnson, A. W. Schultz, R. B.

Junior Grade

Critchfield, W. B., Forest Geneticist, Maria Moors Cabot Foundation, Cambridge, Mass.; Univ. of Calif., B.S.F., 1949; Ph.D., (Botany), 1956.

Lane, S. P., Wood buyer & Supv., Eastern Corp., Enfield, Maine. Reinstatement.

Affiliate Grade

Sinclair, J. G., Field Contact Rep., Pingree Timberlands, St. Francis, Maine.

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK

Bonnlander, J. V.

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

Rodgers, D. K.

Northern Rocky Mountain Section

Junior Grade

Garrick, N. L., 7 Gallatin, Missoula, Mont.; Mont. State, B.S.F., 1956. (Student, 1955).

Member Grade

Warren, C. J., Vice President, Intermountain Lbr. Co., Missoula, Mont. (Junior, 1949).

Puget Sound Section

Junior Grade

Drake, E. G., Forester, Wash. Excelsior & Mfg. Co., Seattle, Wash. Reinstatement.

Southeastern Section

Student Grade

UNIVERSITY OF GEORGIA

McAlpine, R. G.

Junior Grade

Clarke, J. W., Forest Mgmt. Asst., Ga. Forestry Comm., Atlanta, Ga.; Univ. of Ga., B.S.F., 1939.

Johnson, H. R., Box 4054, Port Wentworth, Ga. Reinstatement.

Member Grade

Kreager, P. T., Refuge Mgr., St. Marks Natl. Wildlife Refuge, St. Marks, Fla. Reinstatement.

Levi, A. C., Field Asst., International Paper Co., Bay Minette, Ala.; A. P. I., B.S.F., 1950. (Junior, 1955).

Affiliate Grade

Bates, R. H., Dist. Forester, Interstate Land & Imp. Co., Talbotton, Ga.

Upper-Mississippi Valley Section

Student Grade

IOWA STATE COLLEGE

Ketchum, R. L.

UNIVERSITY OF MINNESOTA

Lankton, J. F.

Junior Grade

Groom, W. J., Iowa State College, Ames, Iowa; Iowa State, B.S.F., 1956. (Student, 1956).

Hedlund, R. E., Tofte, Minn.; Univ. of Minn., B.S.F., 1934.

How, D. C., 913 Sheridan, Brookfield, Ill., Iowa State, B.S.F., 1956. (Student, 1955).

Kennedy, W. V., Dist. Ranger, U.S.F.S., Aurora, Minn. Reinstatement.

Larsen, D. M., County Ext. Forester, Univ. of Minn., Virginia, Minn. Reinstatement.

Peterson, B. G., Upson, Wis.; Univ. of Minn., B.S.F., 1956. (Student, 1955).

Quirk, J. T., 121 Beech Ave., Ames, Iowa; Iowa State, B.S.F., 1956. (Student, 1955).

Rudolph, T. D., Box 26, Bowlus, Minn.; Univ. of Minn., B.S.F., 1956. (Student, 1955).

Washington Section

Member Grade

Fetzer, C. D., Staff Soil Conservationist, U. S. D. A., Washington, D. C. Reinstatement.

Wisconsin-Michigan Section

Student Grade

MICHIGAN STATE UNIVERSITY

Kauma, T.

UNIVERSITY OF MICHIGAN

Mallette, D. H. Miller, J. A.

McGarvey, G. H.

Junior Grade

Best, J. H., Rt. 4, Box B, Lansing, Mich.; Mich. State, B.S.F., 1956. (Student, 1954).

Freydl, R. B., 455 Eaton Drive, Northville, Mich.; Mich. State, B.S.F., 1956. (Student, 1954).

King, R. E., Dist. Forester, Ausable State Forest, Grayling, Mich.; Univ. of Mich., B.S.F., 1949.

Affiliate Grade

White, W. B., Area Supv., Consolidated Water Power & Paper Co., Rhinelander, Wis.

Associate Grade

Sawyer, C. J., Pres., Sawyer-Stoll Co., Escanaba, Mich.

Corresponding Grade

Koehler, W. P., Forestry Secretary, German Embassy, Washington, D. C.

Van Eck, W. A., Grad. Research Asst., Mich. State, East Lansing, Mich.; Mich. State, M.Sc., (Soil Science), 1954.

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Forestry News

1,200 Leaders Attack South's Incendiary Problem

Some 1,200 persons met in New Orleans on April 13-14 with the intent of doing something about the South's problem of incendiary fires. Woods burners in that region are attributed with more than 38,000 forest fires per year deliberately set on other peoples' property. The loss from forest fires in the region is estimated at $250 million annually.

Primary purpose of the conference was to spark action on the local level by conference delegates to deal with the woods burner. Vigorous educational activities coupled with equally vigorous law enforcement were pronounced a first major step. Of the large total attendance, about 140 were profesional foresters, demonstrating the concern with the problem now held by the general public. About 50 percent of the attendance was made up of legal and enforcement people and educators, clergymen, and civic groups.

Sponsors of the successful conference, under the general chairmanship of Lowell Besley, director-forester of the American Forestry Association, included 11 conservation, industrial, and citizen's groups who carried on its organization with the endorsement of the Conference of Southern Governors.

The May issue of *American Forests* magazine is devoted to a report of the conference.

Newsprint Consumption in 1955

The consumption of newsprint in the U. S. for 1955 totaled 6,366,000 tons, an increase of 284,000 tons or 6.3 percent over 1954, according to an interim report of the House Committee on Interstate and Foreign Commerce.

In the United States, in 1955, 1,458,000 tons was produced, a gain of 266,000 tons or 22 percent over 1954.

The estimated demand for 1956 is 6,850,000 tons compared with an expected supply of 6,810,000 tons. U. S. production in 1956 is expected to step up to 1,630,000 tons, a gain of 172,000 tons or 11.8 percent over 1955.

WINNER of the 4th annual "Keep Virginia Green" poster contest. This poster, prepared in color by David B. Lewis, high school senior of Richmond, won the annual contest sponsored by Virginia Forests, Inc. in cooperation with the Virginia Building Material Association. The poster will be reproduced in color on approximately 350,000 book covers which will be distributed to Virginia school children next fall. Over 1,100 entries were submitted in the contest.

William L. Hall Honored at Luncheon

William L. Hall, one of the charter members of the S.A.F., was honored March 28 at a luncheon meeting of the Hot Springs, Ark. Rotary Club as "one of the profession's most respected and beloved practitioners."

Mr. Hall, now nearing his 83rd birthday, is still engaged in forest practices on his own privately owned Arkansas woodlands.

Tribute to the forester was paid in an address by E. L. Demmon, director of the Southeastern Forest Experiment Station, U. S. Forest Service. Demmon, as president of the S.A.F. in 1954, presented Hall with the Gifford Pinchot medal for outstanding service to forestry.

Mr. Hall received from Jacob L. King, Rotary president, an appreciation award for his record of "service above self." On behalf of Governor Orval Faugus of Arkansas, Ishmael Beam, president of the Hot Springs Chamber of Commerce, presented Hall with the Arkansas Traveler Award.

Yugoslavia Aids United States in Fighting Gypsy Moth

Yugoslavia and other European countries are helping federal and state pest-control officials to fight the gypsy moth in the United States, the U. S. Department of Agriculture reports.

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RECENTLY dedicated was this $300,000 Forestry Building at Louisiana State University. The structure is unique in that each of its rooms is paneled in a wood native to Louisiana. The lumber industry of the state donated the wood. The LSU School of Forestry teaches forest production, forest utilization, wood technology, and forest and game management.

Ralph F. Holbrook and Edgar D. Eckess, entomologists of the Agricultural Research Service, have gone to Yugoslavia to arrange for collecting and rearing female gypsy moths, which yield an attractant needed in trapping hard-to-find males. Traps are used in surveying the extent of infestations, an essential step before control work is started.

The Yugoslavian Forest Service Institute has offered to use its equipment and personnel to aid in collecting the large quantity of material needed in the United States. Agricultural agencies in Portugal, Spain, and France are also aiding Holbrook and Eckess in surveying gypsy-moth abundance in those countries, to see whether future collections there might be practical.

During the past 2 years, the gypsy moth has spread beyond its 80-year-old New England boundaries into almost 9 million previously uninfested acres of the northeastern United States. As a result, greatly expanded detection and control programs are being planned. Paradoxically, despite the recent spread of the pest from New England, there are not enough large concentrations of the moths in this country to provide the material needed for trapping surveys.

Scientists Use Virus Disease to Kill Sawfly

The Virginia pine sawfly, an insect pest of pine trees in the eastern and central United States, has been controlled in localized areas with a virus-disease spray, the U. S. Department of Agriculture reports.

This achievement, coupled with earlier (1951) successful virus control of the European pine sawfly, leads Department scientists to believe that there is considerable hope for the eventual practical use of diseases against many forest insects.

Insect pathologists S. R. Dutky, J. V. Thompson, and C. G. Thompson of Agricultural Research Service and entomologist J. M. Davis of the Forest Service obtained, as a result of several experiments carried out in Maryland in 1955, 77-percent to nearly complete kills of sawflies with the virus sprays. Their tests further showed that the virus of the Virginia pine sawfly affected the European pine sawfly, and vice versa.

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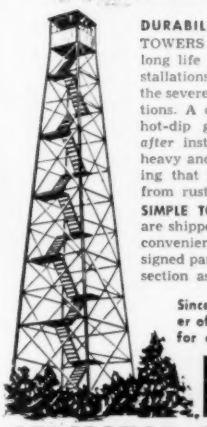

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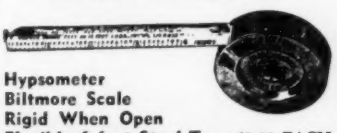

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600 Attend Woods Demonstration in South Carolina

The Seaboard Air Line Railroad Company with the cooperation of the State Forestry Commission, teachers of vocational agriculture departments from five South Carolina counties, the Soil Conservation Service, the Extension Service, the U. S. Forest Service, and business and industrial organizations held a woods demonstration March 30 on Mulberry Plantation near Camden, S. C. showing the latest in forestry methods. A total of 600 persons attended.

U. S. Representative W. J. Bryan Dorn predicted the forestry industry would help South Carolina climb to "where it was in 1859 with the highest per capita income in the nation."

Discussions and demonstrations were given by leading industrial organizations in the South covering a wide range of forestry and forest utilization subjects.

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Tennessee Steps Up Keep Green Program

A joint meeting of the Tennessee Conservation League and the Keep Tennessee Green Association was held March 30 in Memphis.

Ernest A. Clevenger of Corley Manufacturing Co., Chattanooga, was elected president of KTG for 1956. Organization plans for the year call for expansion on a county level throughout the state with a vigorous program of Keep Green activities. Clevenger called for his organization's support in seeking the establishment of a U. S. Forest Service research center in Tennessee.

Education

L.S.U. Holds Forestry Symposium

Nearly 400 foresters from all parts of the South attended the Fifth Annual Forestry Symposium on the theme, "Forest Management in Plan and Practice," held April 5 and 6 by the Louisiana State University School of Forestry.

Papers presented at the meeting included "The Scope of Forest Management Plans" by Kenneth P. Davis, University of Michigan; "Preparation of Industrial Forest Management Plans" by Donald Stevenson, Buckeye Cellulose Corporation; "Management Planning for a Southern National Forest" by Paul A. Swarthout, Ozark National Forest; "The Place of the Consulting Forester in Management Planning" by Lewis C. Peters of Frank Bennett and Associates; "Opportunities for Forest Industries to Improve Management Practices on Small Woodlands" by William M. Bailey, International Paper Company; "Management of Pine-Hardwood Stands in Southern Arkansas" by R. R. Reynolds, Crossett Research Center; "How Should Southern Hardwoods be Managed?" by H. R. Tomlinson, U. S. Forest Service, Atlanta, Ga.; "The Use of Business Machines in Forest Management" by Douglass Craig, U. S. Forest Service, Atlanta, Ga.; "Continuous Forest Inventory" by R. V. Malecki, Union Bag and Paper Corporation; "An Approach to Keeping Management Records" by James W. Bryan, Dantzler Lumber Company; and "Tricks in Sampling Tree Volume" by L. R. Grosenbaugh, Southern Forest Experiment Station.

The proceedings of the meeting will be published and will be ready for distribution in the next few months, Dr. Paul Y. Burns, director of the

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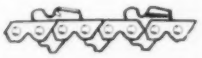

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L.S.U. School of Forestry, announced. The publication will be distributed by the General Extension Division of L.S.U. at $1.50 per copy.

George Drake Lectures at California

George L. Drake gave a series of lectures at the School of Forestry, University of California from April 16 to April 21.

Mr. Drake was named Winton lecturer in industrial forestry and is the first man to be so appointed under a grant from the Winton Companies fund of Minneapolis. The purpose of the grant is to encourage understanding of current problems of the industry.

Mr. Drake, a consulting forester and past president of the S.A.F., has for many years pioneered in encouraging diversified use of wood to conserve timber resources.

Colman Memorial Fund Established

A memorial fund to aid in training young men for research in watershed management is being established by the family and friends of the late Edward A. Colman.

Dr. Colman was in charge of watershed management research at the California Forest and Range Experiment Station of the U. S. Forest Service from 1949 until his death at 45 on March 20.

Several California colleagues of Dr. Colman have been asked by Mrs. Colman to serve as an advisory committee to aid in establishing the fund. They are Joseph Kittredge of Sebastopol, Charles J. Kraebel of Berkeley, J. Donald Sinclair of Glendora, Henry W. Anderson of Lafayette, and Clark H. Gleason of Oakland, chairman.

The fund will be used to provide graduate training for young scientists who are so urgently needed in the field of watershed management. The Bank of America has been designated trustee for the fund.

Donations to the "Edward A. Colman Memorial Fund" may be sent c/o O. C. Little, cashier, Bank of America, P. O. Box 242, Berkeley 1, Calif.

New York Holds Lumber Grading Short Course

The eighth annual short course in hardwood lumber grading was held recently at the State University of New York College of Forestry in Syracuse. The five-day short course was given under the direction of Professor Raymond J. Hoyle, chairman of the Dept. of Forest Utilization. This was the eighth consecutive year he was director of the program.

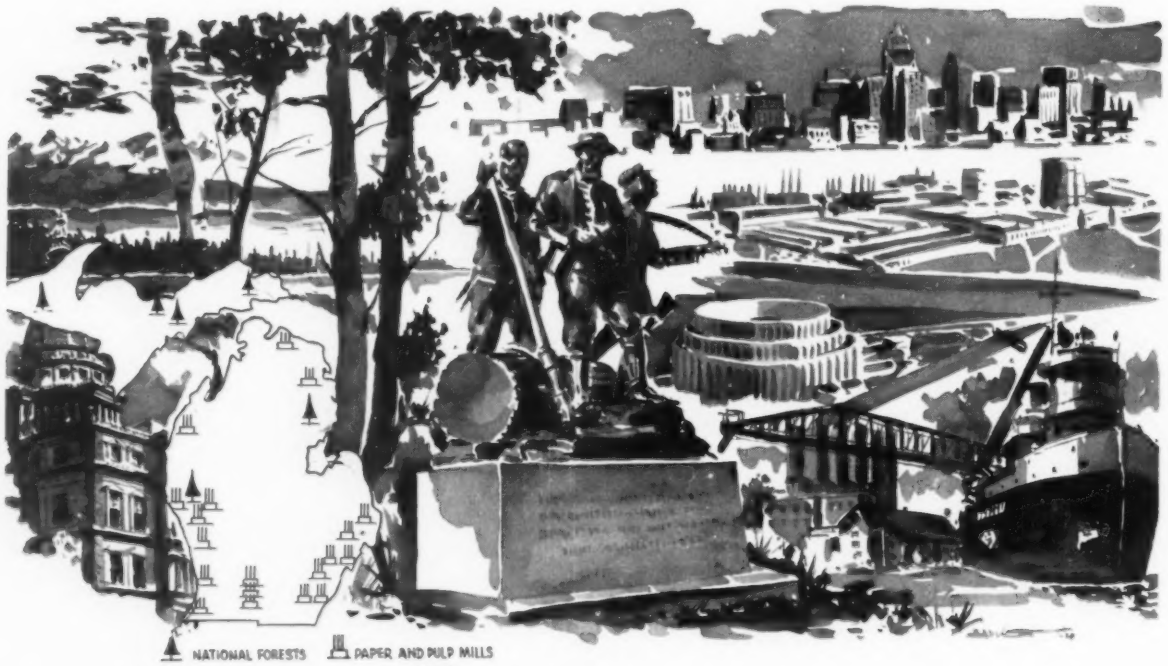
A total of 26 men from sawmills, wholesale distributors, woodworking factories, inspection agencies, and government were enrolled.

Industrial and Private

Particle Board Industry Seeking Marketing and Standards Organization

The new particle board industry, now headed by a special committee under the leadership of Burton F. Swain, Jr., president of the National Veneer and Lumber Company, Seymour, Ind., is making a survey of more than 50 firms now interested in particle board production, equipment manufacture, marketing, research and testing. The purpose of the survey is to bring together information on the infant industry and to determine the need for an industry association.

No. 20 of a series featuring forestry practices, projects and products . . .



Michigan

—a hardwood state with a promising future

Michigan's forests have contributed significantly during the past century to the nation's lumber pile. From 1870 to 1900 the state led all others in lumber output,—reaching peak production of five and one-half billion board feet in 1889 and holding over one billion feet annually until 1917.

Today, about 19 million acres of Michigan forest land remain,—52 percent of the total land area. Hardwoods account for the greater share of the timbered acres, with aspen,—once despised as a weed tree and now favored by the pulp and paper industry,—occupying 6 million acres alone.

Present commercial forests supply the wood needs of Michigan lumber, pulp and paper, veneer, furniture and other timber dependent industries. In addition, these forests supply the state's maple sugar industry—in which Michigan ranks fifth in the nation.

Michigan's record of fire protection and suppression on its forested acres is among the best in the nation. Organized protection includes all of the state's forestland and some non-forest land. Landowners began planting trees of commercial species about 1909, and in 1949, the state became an active participant in the American Tree Farm System.

Enlightened forest management and greater respect for the value of tree species once judged worthless give Michigan a promising forest future.

* * *

Alert forest management today assigns important new roles to Southern Glo boundary paints. Once reserved almost exclusively to mark areas for plot cutting, these paints are now used in growth studies, in marking seed trees, and for various other designations which remain valid over a prolonged period. Interesting and practical new techniques use this paint for marking positive permanent boundary lines.

Produced on the stay-mixed formula that distinguishes all Southern Glo forestry paints, boundary marking paint is easier and more economical to apply than metal tags or blaze marks. Its clear mark is noted more readily from a distance . . . remains visible for 5 to 10 years.

We invite you to consider Southern Glo boundary marking paint next time you have a marking problem involving long durability.

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International Plans New Southern Newsprint Mill

International Paper Company has recently announced plans to construct a new $57 million plant at Pine Bluff, Ark. to produce annually 130,000 tons of newsprint and 165,000 tons of bleached kraft board.

International now is completing a 115,000-ton mill at Mobile, Ala.

The company has a staff of 450 foresters who manage company lands and work with small landowners in extending better forest practices.

Public

Forest Service Reports on Insect Control Work for 1955

Approximately 2,274,300 acres of timberland seriously infested by leaf-eating insects were aerially sprayed in 1955 by the Forest Service in cooperation with state forestry agencies and private timberland owners, the U. S. Department of Agriculture announces. In addition 450,000 trees were sprayed individually to control bark beetles.

The Forest Service estimates that over 5 billion board feet of saw timber on commercial forest land are killed by insects each year and that insect attacks of that same year will, over a period of time, cause 3½ billion board feet loss of growth.

The largest insect control project of 1955 was against the spruce budworm. Approximately 2,262,700 acres in Montana, New Mexico, Idaho, Washington, and Oregon were aerially sprayed. The remaining 11,600 acres were sprayed for tent caterpillar, Saratoga spittlebug, fall webworm, and European pine shoot moth.

Second largest campaign was against the Engelmann spruce beetle which can be controlled only by logging or by spraying individual trees. Some 257,200 trees in Colorado were sprayed for this beetle, and another 90,000 were logged.

Almost 400 million board feet of Engelmann spruce was logged in Montana and northern Idaho in an intensive bark beetle control program. The remaining 192,800 trees were sprayed to control western bark beetles, southern pine bark beetles, and turpentine beetles. Control work is done under provisions of the Forest Pest Control Act of 1947.

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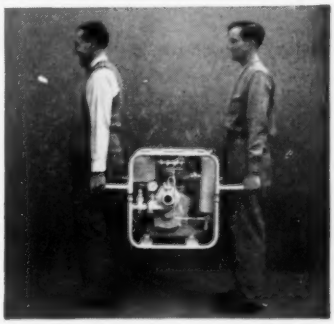
FZ	50 300	60 10
HPZF	15 45	200 100



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Jesse H. Buell Retires

Retirement of Dr. Jesse H. Buell, chief of forest management research for the Rocky Mountain Forest & Range Experiment Station at Fort Collins, Colorado, since 1951, has been announced by Director Raymond Price.

Entering the Forest Service in 1924, Buell served first as timber sales assistant on the Snoqalmie National Forest at Seattle. Two years later he was transferred to the Southeastern Forest Experiment Station at Asheville, North Carolina, where he began his career in forest research. In 1935, he was temporarily detailed to the Washington Office to work on problems in silviculture and statistics. In 1945, he was transferred to Washington and appointed assistant to the chief of the

JESSE H. BUELL

Division of Forest Management Research.

Dr. Buell is a recognized authority on silviculture and forest measurement techniques. He is author of more than twenty-five technical articles and publications.

A native of Connecticut, Buell received his B.S. degree from Wesleyan University in 1922, his M.F. from Yale in 1922, and his Ph.D. from Duke in 1943. He is a member of Sigma Xi, Phi Beta Kappa.

Forest Service Veteran Retires

Jack V. Leighou, supervisor of the White River National Forest, with headquarters at Glenwood Springs, Colo., will retire this month after more than 40 years of public service on national forests of the Rocky Mountain Region in Colorado, Wyoming, South Dakota, and Minnesota.

A forestry graduate from Penn State College in 1913, Leighou entered the Forest Service as a field assistant on the Bighorn Forest in Wyoming in 1911. In 1919, he was made forest examiner and served in this capacity on the Harney and Colorado Forests until 1921 when he was promoted to supervisor of the Arapaho Forest in Colorado. In 1930, he transferred to the position of supervisor of the Gunnison Forest; and went to the Holy Cross Forest in the same capacity in 1938. When the Holy Cross and White River Forests were consolidated in 1945, he became supervisor of the combined unit at Glenwood Springs where he has remained up to the present time.

As a result of Leighou's retirement, Edward H. Mason, presently supervisor of the Roosevelt National Forest at Fort Collins will move to Glenwood Springs as the new supervisor of the White River. G. D. Pickford, supervisor of the Routt Forest at Steamboat Springs will shift to Fort Collins as supervisor of the Roosevelt Forest and Robert W. Gardner, forest staff assistant on the Roosevelt moves up to supervisor of the Routt.

J. R. Hansbrough Heads Disease Research

John R. Hansbrough, of the Northeastern Forest Experiment Station, has been named chief of the Division of Forest Disease Research at Washington, D. C., the U. S. Forest Service announced. He succeeds Lee M. Hutchins, who retired December 31, 1955.

Dr. Hansbrough has been with the Northeastern Forest Experiment Station since 1953 when the forest disease research work was transferred to the Forest Service from the Bureau of Plant Industry, Soils, and Agricultural Engineering. He was made chief of the forest disease research at the station in September 1954.

He has been associated with forest pathology work in the Department for 30 years. His assignments have included investigations on diagnosis and control of decays and discolorations for forest products, study of the epidemiology of white pine blister rust in the West, and extensive research on diseases of forest trees in the Northeast. From September 1948 until he joined the Forest Service, he was in charge of the Bureau of Plant Industry's field laboratory of forest pathology at New Haven, Connecticut.

Dr. Hansbrough received his Ph.B. and M.A. degrees in botany and biology from Brown University and his Ph.D. degree in forest pathology and forestry from Yale University.

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"A marked reduction in the mortality of the small trees was noticed immediately after application of SUNOX," another large grower in the South reported. "We made three applications on the affected areas with significantly good results."
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Regional Fire Chief Retires

Roy L. Williams, chief of the section of forest fire control in the Denver Regional Office of the Forest Service, will retire May 21, 1955 after more than 30 years as ranger, supervisor, and forest fire control expert in Colorado, Wyoming, South Dakota, and Nebraska. Regional Forester Donald E. Clark made this announcement. Williams' ability in the fire control field has been recognized by his selection for an F.A.O. assignment in Venezuela to plan a forest fire prevention and control program for that country immediately following his retirement from the Forest Service.

A veteran of World War I, Williams entered the Forest Service on the Harney National Forest as forest ranger in 1923, after which he served in various administrative capacities. He was appointed supervisor of the Grand Mesa Forest in 1945, moving to the Bighorn in the same position in December 1948. In 1952, he transferred to the Regional Office as chief of fire control.

Williams' position in the regional office section of forest fire control will be filled by transfer of Wendell Harmon, presently forest staff assistant on the Black Hills National Forest from Custer, S. Dak. to Denver.

Wayne-Hoosier Supervisor Change Announced

Rudolph H. Grabow, supervisor of the Wayne-Hoosier National Forest in Ohio and Indiana retired March 31, it has been announced by Regional Forester H. Dean Cochran. He has been succeeded by Howard C. Cook.

Mr. Grabow first entered the U. S. Forest Service in 1920 at the Forest Products Laboratory in Madison, Wis. He left the Service in 1927 to return in 1934, when he was employed on the Nicolet National Forest in Wisconsin. Two years later he became assistant chief of the Division of Information and Education in the North Central Region office. In 1939 he became supervisor of the Hoosier, to which the Wayne purchase unit was added in 1949.

Mr. Cook has for the past three years been in the Division of Timber Management of the Pacific Northwest Region, Portland, Ore. Except for this period he has been with the Forest Service in the North Central region since first appointed district ranger in 1934. He served for three years during World War II and when released from military duty was commanding officer of a forestry company.

Allied

Election Results for The Wildlife Society

Newly elected officers of The Wildlife Society for 1956-57 are: president, Durward L. Allen, Purdue University; and vice president, John S. Gottschalk, U. S. Fish and Wildlife Service, the Wildlife Management Institute reports. Daniel L. Leedy, Fish and Wildlife Service, is the Society's secretary-treasurer. Regional representatives are: Roger Latham, Pennsylvania Game Commission; Edward B. Chamberlain, Florida Game and Fresh Water Fish Commission; Bill Crawford, Missouri Conservation Commission; Lee E. Yeager, Colorado Cooperative Wildlife Research Unit; Wendall Swank, Arizona Game and Fish Commission; A. Starker Leopold, University of California; and Ian McTaggart Cowan, University of British Columbia.

Products and Equipment

Research Develops Two New Pine-Gum Products

Two new chemical products of pine gum, developed by U. S. Department of Agriculture scientists at Olustee,

CUT COSTS 90%
PREVENT ACCIDENTS
• WASH WINDOWS FOUR STORIES HIGH
REMOVE LIGHT GLOBES 60 ft. up
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For rough usage, unburnable, all metal. Simple variable tine spread.

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Tine wires are of heat treated spring steel and zinc plated. Tine wires can be easily replaced.

Strong aluminum handle is corrosion proof and will not break, warp or burn.

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Trim your hedges the electric way, with

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TRADE MARK REG. U. S. PAT. OFF.
HEDGE TRIMMER

One-tenth the time of hand shears. Makes hedge-trimming a pleasure and gives a beautiful trim. Light . . . strong . . . rapid . . . easy.

Ask for circular of 16" Model
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Fla., are now available commercially for industrial use, the Department announces.

One of these products is maleopimaric acid, the first industrial chemical to be made directly from pine gum. It is being used by the photographic industry and has applications in paper coatings, printing inks, and other products requiring a plasticizer, emulsifier, or resin.

The other new pine-gum derivative is pinane hydroperoxide (PHP), a catalyst for cold rubber production, with applications also in the production of certain plastics.

Although present output of these two chemicals is limited, their commercial availability represents a major advance in the naval stores industry, the Department says. The Distillation Products Division of Eastman Kodak Company recently announced the addition of maleopimaric acid to their stock of organic chemicals, and the American Cyanamid Company has indicated that it can supply experimental quantities of PHP.

New X-Ray Unit Enables a "Look Inside" Trees

A new, lightweight x-ray unit, developed at Iowa State College, makes it possible quickly to determine the extent of decay in living trees.

In previous studies of this sort it was necessary to cut the trees in order to examine them. Now, two men with an x-ray unit weighing 13 pounds can make better and faster examinations without damage. Furthermore, they can keep each tree under observation for a period of years, watching the development of decay.

The unit was designed, and its usefulness tested by Dr. Harold S. McNabb, Jr., assistant professor of forest pathology; Wallace E. Eslyn, graduate assistant in forest pathology; Milo Voss, health physicist at the Institute for Atomic Research; and Gerald Daly, junior chemist at the Institute for Atomic Research.

A rare metal, thulium, refined at the Ames Laboratory of the United States Atomic Energy Commission is the heart of the unit. When irradiated, the metal produces a radiation effect comparable to that of a 100,000 volt x-ray machine.

Decayed areas are revealed along with other imperfections such as knots and water-filled cavities. By taking a number of pictures, the size and location of defective areas can be determined accurately.

DR. HAROLD S. MCNABB, JR., assistant professor of forest pathology (left), places new portable x-ray unit on bracket fastened to tree as Wallace Eslyn, graduate assistant in forest pathology adjusts holder for film. The unit, developed at Iowa State College, is now being used to "look inside" trees, and to determine extent and progress of decay.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

Position Available

Two openings for young forestry graduates are available in Real Estate Division, Corps of Engineers, Savannah District. Work includes management of timber and other resources, and care of forest recreational areas. Beginning salary $3670.

Submit standard form 57 for federal employment to District Engineer, Corps of Engineers, P. O. Box 889, Savannah, Georgia.

Positions Wanted

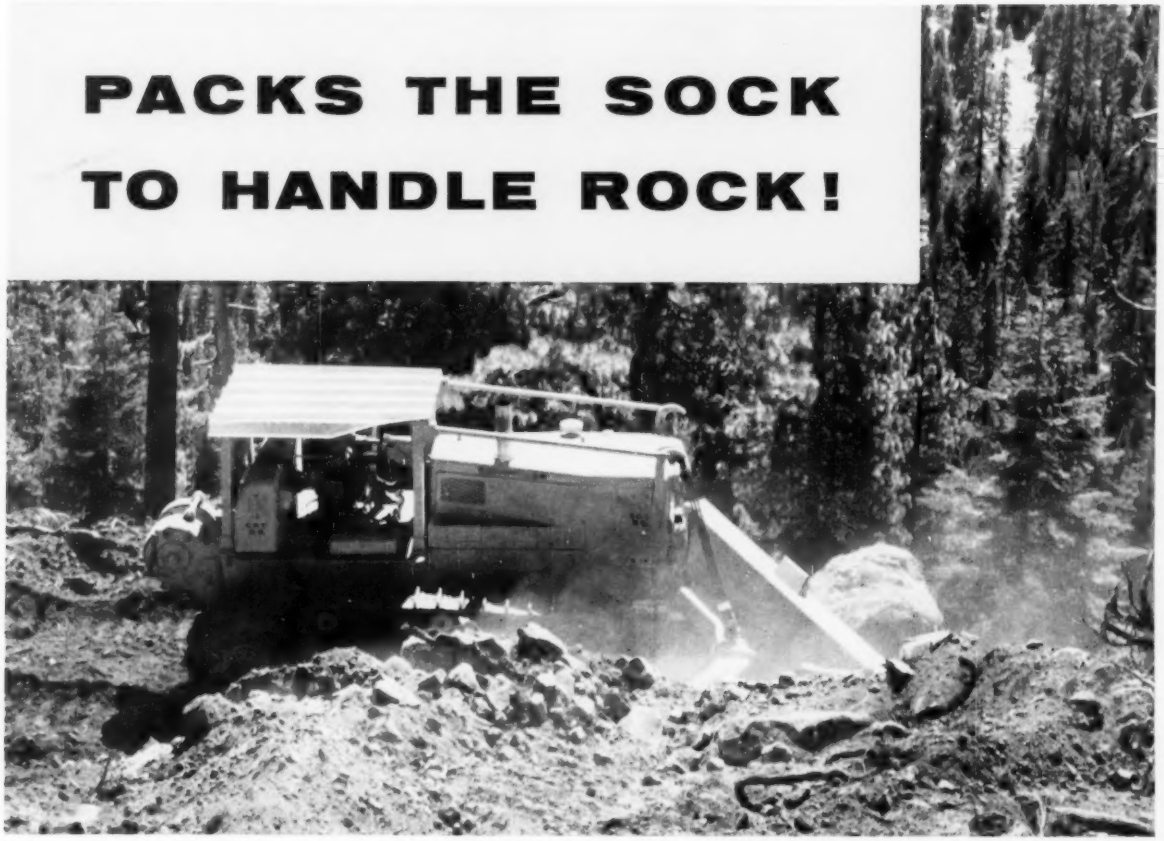
Forester, B.S., 1952, New York State College of Forestry. Age 25. Single. Currently employed by a midwestern state forestry division. Also experienced in West coast timber cruising. Far Eastern Army experience. Interested in foreign and overseas work regardless of location, if challenging and rewarding.

Box L, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, Age 36; B.S.F., 1943, Pa. State College. Married; 5 children; veteran. Experien ed ten years with large building materials company; forest-timberland acquisition and management, three years; woodland manager, six years; wood procurement supt., one year. Desire position involving administration, management and field work offering opportunity for advancement. Prefer Lake States or South but would consider elsewhere.

Box M, Journal of Forestry, Mills Building, Washington 6, D. C.

PACKS THE SOCK TO HANDLE ROCK!



This D9 is assigned to 25 miles of new road construction for Collins Pine Co. The outfit is 100% Caterpillar-powered in the woods. Says Logging Superintendent J. E. Garrett: "We get top performance from our Caterpillar-built units in any kind of weather and all conditions. During the winter months, we regularly log in 5 feet of snow with them."

286 HP **CAT*** D9 Tractor with No. 9A Bulldozer picked by Collins Pine Co. to pioneer in rough going

You're looking at a 73,000-pound D9 (as equipped) pioneering a logging road for Collins Pine Co., northeast of Chester, Calif. In many spots, the D9 pioneered work on 40-45° slopes. With its 286 HP heft, it handled material from rocky patches to boulders, maintaining a steady 8-hour-a-day, 5-day-a-week pace.

As big and rugged as the D9 is, it is also easy to operate. Here are some reasons why:

- **Hydraulic boosters provide power steering *and* braking.**
- **Long 7-roller track frame improves stability, flotation and ride.**
- **"In-seat" starting with single lever control insures fast starts in any weather.**
- **Adjustable seat, all-round visibility and easy access to all controls make the operator's job simpler.**

All in all, from its completely new 286 HP Caterpillar Engine to its tough "water-quenched" track shoes for longer wear, the D9 is built to set new production standards in the woods. The first track-type tractor with a turbocharger, it is available with torque converter or direct oil clutch drive, so you can match the drive to your job needs. Ask your Caterpillar Dealer to show you how it can step up your production!

Caterpillar Tractor Co., Peoria, Ill., U. S. A.

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